Technology as an Economic Catalyst in Rural and Depressed Places in Massachusetts

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Technical terms in this study are defined in the glossary, Appendix 1.

Introduction

With the assistance of the United States Economic Development Administration, the University of Massachusetts has investigated how communities of economic distress adapted to the past decade cutback of defense expenditures in Massachusetts. The UMass team for this project includes the Donahue Institute of the University of Massachusetts Presidents' Office; the Center for Economic Development located at the University's Amherst campus; and the William Monroe Trotter Institute based on the University's Boston Campus.

We examined the role of technology as a potential economic catalyst in rural and depressed places in Massachusetts through selected case studies. The five targets of the case studies include two cities (Lynn and New Bedford), a sub-city district (Roxbury), and two towns in rural Franklin County (Greenfield and Orange). Though the five target areas vary in size, density, geographic area, demographic characteristics, and regional economic resources, each area exhibits chronic patterns of economic distress related to the decline of manufacturing, construction and other key industries within the city or labor market area.

The Military Context

Military spending can be broken into two broad categories. The most obvious is direct spending on military facilities and salaries. Massachusetts has seen base closings throughout the state, including western Massachusetts (Westover Airforce Base), central Massachusetts (Fort Devens), southeastern Massachusetts (South Weymouth Naval Air Station) and Metro-Boston (Watertown Arsenal). Less obvious, and keystone of this study, are the defense department investments that have seeded technology development and technology employment.

The national defense buildup during the 1980s is widely acknowledged to have been an underpinning of the overall Massachusetts' economy in the 1980s.[1] By the end of the decade the Commonwealth ranked third in the value of prime defense contracts and third in the proportion of total private sector jobs reliant on defense contracts among the 50 states of the union. Between 1989 and 1999, however, defense contracts in Massachusetts declined by more than $4 billion, or 46% in constant dollars and 58% in constant dollars (Department of Defense and Department of Commerce Consumer Price Index).

Though fortuitous, the infusion of defense dollars during the military build-up of the 1980s had an uneven impact in Massachusetts, and the legacy of that impact continues to illustrate economic "winners" and "losers." Defense investment led to major growth in some areas of the Commonwealth, lowering unemployment and initiating a boom in real estate development. When disinvestment occurred after 1990, the pool of unemployed professionals proved attractive to the private sector, which in turn led to the private sector technology investment that today exemplifies the Massachusetts economy. In other areas, however, reinvestment never occurred after the infusion of military dollars and promising economic sectors are withering. In yet a third instance, communities isolated by factors such as race, language barriers and/or low educational attainment only marginally benefited during the boom and still sit unaffected on the whole despite a proximity to modern technology infrastructure. The decline in Research, Development, Test, And Evaluation (RDT&E) investments in Massachusetts occurred when these communities still required an infusion of investment capital seeded by the Pentagon to allow their economies to accommodate technology industries.

Prime contracts given to Massachusetts companies were concentrated on the "high-tech" needs of military research, prominently including "electronic and communications systems." Contracts administered under the RDT&E program were one of the two cores of Massachusetts' conversion to a high-tech state.[2] With its concentration of research

[1] See, for example, Choosing to compete: A strategy for Job Creation and Economic Growth, pp.78-79. Commonwealth of Massachusetts and the University of Massachusetts, 1992.
[2] Companies that comprised the mini-computer industry, the second, were also the recipients of defense contracts (primarily sub-contracts).

universities, the Commonwealth was a magnet for RDT&E investments throughout the 1980s. Research and development contracts directed at major universities are a lifeline for current and future technologies. For example, defense spending funds 82% of all electrical engineering research, 75% of mechanical engineering, 73% of metallurgy and materials, 55% of computer science and 28% of mathematics research (Office of Congressman Martin Meehan). During the 1990s, the national RDT&E budget declined by 12%, and the Massachusetts share of that budget has declined from 10% in 1990 to 6.1% in 1999. In terms of dollars, RDT&E contracts declined from $2.2 billion in 1990 to $1.2 billion in 1999, amounting to a 46% decline in nominal dollars and 58% in constant 1990 dollars (DOD and CPI).

As we look back on the 1990s, the development and maintenance of a technologically sophisticated and competitively priced telecommunications infrastructure has never been more critical for economic development. The role of telecommunications infrastructure dates to the 19th century with the invention and commercial applications of first the telegraph and then the telephone.[3] Radio, television and computers were invented during the first half of the 20th century. Defense spending during the cold-war wedded these inventions in "Arpanet" which became the basis of today's Internet.

The modern and emerging Internet relies on public licensing and private investment for broadband fiber-optic new fiber-optic cable that provides two-way capability for high speed internet access, digital telephone service and superior audio and video capabilities. In rural and low-income areas, however, limited private sector investment fosters high costs of Internet service and limited choices for choosing Internet service providers, placing these areas at competitive disadvantages with other locations. Relatively high costs and poor access to modern telecommunications inhibit new business formation and lead to disinvestment by existing companies that require efficient and cost-effective telecommunications access to sustain and grow commercial enterprises.

[3] Also, the 19th century was the dawn of mass marketing and advertising (in print media).

The Digital Divide

A new term has emerged in the latter half of the 1990s: *The Digital Divide*. On the favored side of the *Divide* are prosperous communities with state of the art technology infrastructure. Such infrastructure, also called "info-structure," consists of high speed and cost effective networks that allows for enhanced quality of video and voice transmission for commerce as well as consumer products such as "Web TV." A strong telecommunications infrastructure enables formation of electronic businesses (such as Internet service providers and virtual companies that exist only on through electronic commerce) and enables more mature segments of the business world to integrate the Internet into its operations and sales strategies. Such "info-structure" provides a local competitive cost advantage when using these new and rapidly improving technologies as a tool in forming new enterprises or expanding existing businesses. Priorities for private investment to develop telecommunications infrastructure is often influenced by population densities as an indicator of a potential customer base and cost-effective service delivery. Other factors that lead to investment include the income educational attainment of a population, under the belief that an affluent and educated populace will want connectivity and be able to afford requisite hardware, software and service delivery. In addition, our field research shows that the local industry mix – where "info-structure" is demanded by businesses to remain competitive (or enhance competitiveness) – is an important factor in spurring investment.[4]

Case Study Municipalities at a Glance
1998

	Average Annual Wage as a percent of the U.S.A.	Average Annual Wage as a percent of Massachusetts	Unemployment Rate as a percent of Massachusetts
Greenfield	79%	67%	106%
Lynn	107%	90%	121%
New Bedford	90%	76%	248%
Orange	75%	64%	158%

Source: Massachusetts Division of Employment and Training; Bureau of Labor Statistics

Note: **Roxbury** data, on a sub-municipal level, is not available after the 1990 census. In 1990 the per-capita income of Roxbury was 55% of the Massachusetts level and 65% of the United States.

[4] Two related points should be mentioned. First is the "chicken and egg" argument, that an effective demand for modern technology infrastructure requires the existence of a technology-based industry mix.

Undersides of the *Digital Divide*

We posit three undersides of the *Digital Divide.* First are rural areas where the customer base for telecommunications infrastructure means that firms and households pay a much higher rate than more urban areas for internet connections of similar sophistication, thus putting them at a competitive disadvantage. Moreover, these areas generally have old telephone lines, which are not suited for the demands of the 21st century telecommunications. Greenfield and Orange Massachusetts, in Franklin County, are towns confronting the implications of a digital economy in a rural, small town and low-income area.

The second category is urban areas that do not have cost effective connections. New Bedford falls into this category. While infrastructure is developed in spots for targeted users, there is a general demand for upgrades. In part, our analysis speculates that it is due to the relatively low level of educational attainment, the local industry mix and a high downtown vacancy rate.

The third type of underside of the "*digital divide*" that we examine is where technology in the ground exists, but additional barriers remain to exploiting these technologies for the overall economic development of the host communities. Roxbury (the predominant Afro-American neighborhood in Boston) and the city of Lynn process competitive advantages in hosting telecommunications technology. Internet based firms are growing, particularly in Lynn, yet these areas on the whole remain distressed when compared to Massachusetts.

In the following pages, we look at how municipal and community leaderships in these five areas are grappling with overcoming these various aspects of the *digital divide* to promote local economic development. Our case studies show that outdated infrastructure, a low education rate among the populations and the lack of technology-

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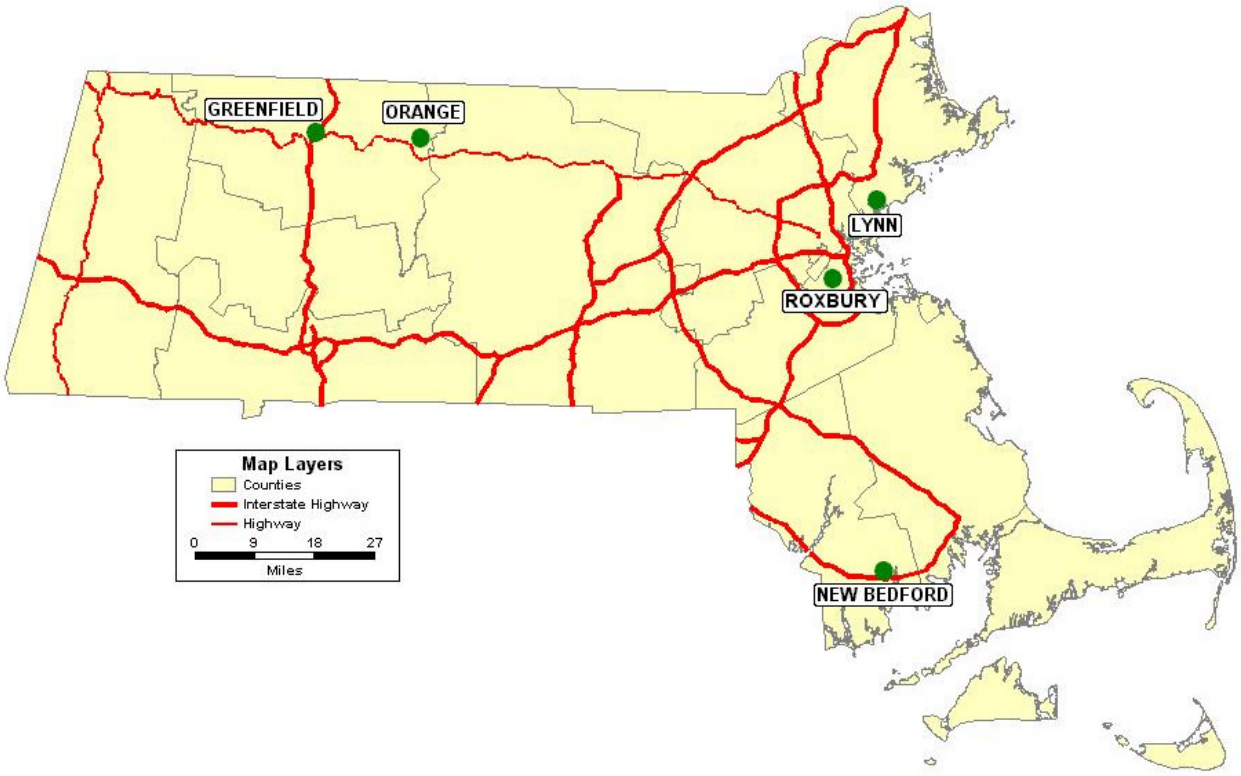
Second, technology may be in part supported on speculation by the public or non-profit sectors in hopes of inducing economic development.

based establishments and technology-consuming companies in the local industry-mix even given a strong infrastructure base, are all competitive disadvantages in the digital economy. Our cases show that the digital economy encompasses:

- Establishments and jobs in technology fields. These may be ISPs such as the establishment of Shore.Net in Lynn and Shay's Net in Greenfield, or heavy users of technology, such as the biotech labs and firms in CrossTown Industrial Park in Roxbury. Without access to "info-structure" these opportunities either would not exist, or would be greatly constricted.
- Long established businesses where the trend is to sell or advertise products over the worldwide web, such as automobile dealerships or furniture stores. The *digital divide*, in this case, can lead to disinvestment if these businesses are losing sales to competitors with better web access. This is a threat to communities that are lagging behind in development of technology infrastructure (Franklin County, New Bedford).
- Community demography, including the educational attainment and income of residents and the types of companies. All our case study communities fall below state averages in education and income, and four of five communities are below a 1998 national wage benchmark. This means that either the private sector is not prioritizing these rural (Franklin County) or poor urban areas (New Bedford) for investment, thus perpetuating the *digital divide*, or that communities with a powerful technology "info-structure" can not fully exploit their competitive advantages (Lynn and Roxbury). Moreover, local markets of consumers, and "connected" companies are attractive targets for "info-structure" investments, and access to the web avails the consuming public to the full variety of goods, services and prices now available through e-commerce in "business to consumer" and "business to business" transactions.

Spurred at first by military investment, the last decade has seen the Massachusetts economy emerge from the recession of the early 1990s as a technology driven economy. The following four case studies of five communities (Orange and Franklin have been consolidated into a single "Franklin County" case) illustrate the multiple barriers and opportunities associated with the *digital divide* in the Commonwealth.

Case Study Communities



Regional Dynamics of Telecommunications Development

Telecommunications development in a region does not happen automatically. Instead, it is driven by the resources, dynamics, and demands of the region and by business priorities beyond a region's control. Our case studies clearly illustrate that geographic location in general and the built environment within the location remain critical factors in a business's ability to participate in the new economy.

Rural and urban businesses in Massachusetts find themselves in vastly different circumstances with respect to availability, capacity, and cost of electronic services. Even within rural and urban regions, there are important differences in levels of service. These differences are fundamentally related to the business priorities of telecommunications service providers. Our case studies clearly show that economic factors related to geographic location play perhaps the largest role in service provision. Locations that promise the most for the service provider get the highest levels of service at the best prices. This bottom-line truth calls into question any notion that the new economy will create a "death of distance," allowing rural and urban business to compete on an equal basis.

Rural Areas

We see quite clearly that rural regions face the most inadequate situation with respect to advanced and affordable telecommunications systems. Only the largest, densest city within the rural region we studied had close-to-adequate electronic service. Even this level of service appears highly inadequate when compared to services available in metropolitan locations. Furthermore, businesses located in smaller, outlying cities and towns or are rurally based face inadequate or non-existent service. Given today's electronically dependent economy, this has grave implications for the economic stability of rural areas. In Western Massachusetts, where successful industrial and commercial centers once thrived in remote areas, this has especially devastating implications.

The reasons for this situation have to do with the geography and the built environment of rural places. Far from major metropolitan areas, and with housing and commercial facilities dispersed across the region, rural regions find market forces working against them. According to Bell Atlantic, deployment of telecommunications resources is based on density more than any other factor: "Our deployment reaches across all income levels, not just the high-income area…it's based on density, not demographics."[5] This revelation challenges a number of assumptions about the potential of the Internet economy to level the playing field for business in rural areas. Our case study of Franklin county clearly shows that, in fact, telecommunications development exaggerates the process of uneven development within and among regions.

Urban Areas

Given these observations about rural areas, it appears that current market priorities for infrastructure development favor urban areas, especially where there is the highest density of "promising" customers.

For the average telecommuter and business, telecommunications options are far superior—in speed and price—in the densest commercial, industrial, and residential areas. According to a recent *Boston Globe* article, "Greater Boston is, by some measures, the most wired metropolitan area in America, with more than 2 million people able to get some kind of high speed Net access (namely broadband access—achieved through cable modems or digital subscriber lines) at their home."[6] This high-speed access (also called broadband access) is achieved through cable modems or digital subscriber lines (DSL), neither of which is available in most rural regions of the state. Private, high-speed lines (T-1 and higher) are available to business customers who pay a premium for the service.

However, we see in our urban case studies that access alone does not guarantee success. Urban areas once able to compete in manufacturing or commerce may find themselves uniquely disadvantaged competing as "New Economy" locations. As the Urban Research

[5] Howe Page 4
[6] (Howe, 2000, p. C4).

Initiative points out, the growth of telecommunications infrastructure and economies has led “to a new urban system in which access to high speed telecommunications, skilled labor force, and information-generating institutions are more important than traditional determinants of growth, such as a deep-water port, cost of labor, or proximity to markets."[7] These factors of location play a critical role in a city's ability to engage in the new economy. Each of our urban case studies faces limitations in one or more of these features.

The findings of our case studies challenge significantly the notion that technology development alone will enhance the capacity of an area to compete, regardless of geography, density, or business culture. In fact, it appears that these factors of location are the critical drivers of information technology development.

[7] (http://www.informationcity.org/about)

Case Study:
Greenfield and Orange

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Overview

Given the wealth of information about the IT-Economic Development connection and the much-discussed "digital divide," it is surprising how little attention has been paid to their intersection. Telecommunications can be a powerful tool for economic development efforts, but the economic digital divide threatens to derail revitalization initiatives throughout the nation. Certain cities and regions find themselves without this tool in their economic development repertoire, and consequently face a severe competitive disadvantage.

Successful integration of the possibilities of the Internet into a local economy requires more than human resources. Even the most knowledgeable, resolute workers and businesses cannot take advantage of a structure that is not physically present. Without the proper infrastructure to provide sufficient bandwidth, the possibilities of utilizing Internet technology to develop, attract, and support businesses is nil. Although the telecommunications industry is currently in a rush to provide ever larger and more powerful systems for businesses to use, the distribution of these resources has not been geographically or economically equitable. Providers naturally seek the greatest return on their infrastructure investments, and thus focus their effort on areas that will provide the most return per dollar. The most profitable strategy is to wire denser, wealthier areas in order to attract the greatest number of high-paying customers while minimizing the amount of cable and other physical infrastructure that must be installed. As a result, the poorest, most rural communities, those most in need of economic-development tools, are those least likely to receive the utility upgrades they need. The town of Greenfield and its environs are examples of this phenomenon.

Telecommunications Development in the Region

The situation faced by Greenfield, Orange, and the other communities in Franklin County sheds light on regional, geographic, and built-environment issues that impact telecommunications development. The situation illustrates quite clearly that rural regions,

far from major metropolitan areas, with dispersed housing and commercial facilities, face major challenges to building advanced and affordable telecommunications systems.

According to Verizon (formerly Bell Atlantic), deployment of telecommunications resources is based on density more than any other factor: "Our deployment reaches across all income levels, not just the high-income areas . . . it's based on density, not demographics."[8] This revelation challenges a number of assumptions about the potential of the Internet economy to level the playing field for business across geographic areas. In fact, our case study of Franklin County shows that telecommunications act to exaggerate the process of uneven development within and among regions. Telecommunications development in a region does not happen automatically. It is driven by the resources, dynamics, and demands of the region and by business priorities beyond the region's control.

Finally, it appears that current infrastructure development actually increases the value of dense residential, commercial, and industrial areas. For the average telecommuter and the average business, telecommunications options are far superior in the densest commercial, industrial, and residential areas. This finding significantly challenges the notion that technology development will let everyone compete, regardless of geographic location. In fact, it appears that geography—both regional and local—and built-environment factors related to market density are the critical drivers of information-technology development.

The situation in Franklin County provides examples of how unevenly economic development proceeds in the information age. While it is beginning to nourish a cluster of telecommunications-based industries, the county is already behind the game. According to Internet service providers in the region as late as 1997, telecommunications

[8] Peter J. Howe, "Agreement to Put Mass. in Internet's High-Speed Lane," *Boston Globe,* January 26, 2000, pp A1, B6.

infrastructure has been limited or nonexistent, far behind where it needed to be considering the potential for growth in the region.[9]

Service available widely in the Boston metropolitan area, for example, simply does not exist in Franklin County. According to a recent *Boston Globe* article, "Greater Boston is, by some measures, the most wired metropolitan area in America, with more than 2 million people able to get some kind of high speed Net access (namely broadband access — achieved through cable modems or digital subscriber lines) at their home."[10] High-speed access (also called broadband access) is achieved through cable modems or Digital Subscriber Lines (DSL), neither of them available anywhere in Franklin County. Private high-speed lines (T1 and higher) are available to business customers who pay a premium for the service, but are subject to long-distance phone rates.

Within Franklin County, the best technology available is through Integrated Services Digital Network (ISDN) lines, which are available only within two miles of a phone company's central office. Greenfield center is such a location; however, the rest of the county is progressively more isolated from this center. Sparse and dispersed residential and business development throughout the county fails to generate the intensity of demand necessary to drive development of the network throughout the region. According to some providers in the county, "a form of red-lining occurs because it is not cost effective to run miles of fiber cable to serve fewer customers."[11] There is a general consensus that major providers have been reluctant to build new infrastructure and have been slow to comply with requests for better equipment from local providers. Clearly, Franklin County finds itself seriously disadvantaged in its ability to harness the benefits of the Internet-based economy.

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[9] Franklin County OEDP Annual Report, 1998.

[10] Peter J. Howe, "For Some, Broadband is Too Slow in Coming to Town." *Boston Globe*, January 26, 2000, p. C4.

[11] Franklin County OEDP Annual Report, 1998.

Using this overview of uneven telecommunications development as background, we will explore in more depth the various factors that come into play in Franklin County.

Economic History

Greenfield is the seat of Franklin County, a rural area of northwestern Massachusetts. Settled originally as a section of Deerfield, Greenfield grew as a farming community, and then as the commercial and political center for the region. Set in the rich soil of the Connecticut River Valley, Greenfield was ideal for farming. The Connecticut also provided waterpower for early mills to process local agricultural products. The ease of transportation along the river created strong connections with the communities to the south, especially Springfield, and to the north, including the river city of Brattleboro, Vermont. At the same time, the Mohawk Trail (now Route 2) connected the city to the western part of Massachusetts and to upstate New York.

The waterpower and transportation provided by the river also led to the creation of a thriving industrial sector. Like many New England mill towns, the presence of industries powered by water attracted other companies, producing a critical mass of industry, which continued to thrive as operations converted to other forms of power. East-west rail links connected the town to eastern Massachusetts and upstate New York, and the rail line running along the river strengthened the connection to Hampshire County to the south.

Other towns in the region, notably Orange, 20 miles east of Greenfield, developed their own local industries. The Miller's River served as Orange's water source, while the Boston-to-Albany rail line provided rail access.

As a county center and lively mill town, Greenfield developed a thriving downtown. Thanks to the presence of public institutions such as the courthouse, large industrial operations such as Greenfield Tap and Die, and supporting commercial operations, Main Street developed into an urban central business district in the heart of rural Franklin County. At the time of World War II, Greenfield could boast prosperous agricultural and industrial sectors.

In the postwar period, Greenfield's industrial sector followed a pattern similar to many New England mill towns. Most important was the movement of manufacturing and other heavy industrial jobs away from the Northeast, as businesses sought less-regulated and lower-wage areas of the country and the world. This led to a serious erosion of Greenfield's economic base. This trend has continued to the present, with manufacturing employment declining from 10.5 percent of total employment in 1990 to 9.6 percent in 1997. The factories that remain are generally high-end producers of specialty items, such as Bete Fog Nozzle, which makes precision industrial equipment, and the Small Corporation, which makes display cases. Nonetheless, unemployment has remained lower in Greenfield than in many communities that found themselves in a similar situation. However, Greenfield, like Franklin County in general, has had stagnant or declining labor forces and populations for years, as residents seek economic, educational, or lifestyle opportunities outside the region. While substantial growth has occurred in some of the smaller towns in the region, particularly Amherst and its environs, the larger towns have seen only slight growth or declines in the 1980s and 1990s.

The automobile's impact on downtown Greenfield has been much less detrimental than in many similar towns. The construction of Interstate 91 and Route 2, which intersect in the northern part of town, has allowed the city to maintain its transportation advantages without substantially detracting from downtown. The nearest large shopping center is in Holyoke. Franklin County's small population (70,597 in 1998) and its low per-capita income ($22,488 in 1996, making Franklin the lowest-income county in the state) seem to have made the area unattractive for the developers of shopping malls, allowing retail activity to remain concentrated around Main Street. As a result, Greenfield's downtown has, to a large extent, preserved its position as the major regional retail center. Though some large operations, such as Fleet Bank and Rich's Department Store, left Greenfield in the 1990s, Main Street continues to be a thriving, lively central business district, featuring restaurants, shops, grocery stores, and even a department store. Greenfield's commercial vacancy rate has remained around 10 percent throughout the 1990s. Orange, which has had the steepest drop in manufacturing employment in the region, currently

has a commercial vacancy rate of 22 percent, an improvement from the 32 percent vacancy rate of 1996. That year, the vacancy rate for downtown Orange was 41 percent.

The loss of industry continues to be the overriding economic development concern in Greenfield and in the region. A lack of available, useful industrial space is a major concern for both Greenfield and Orange. Both have developed industrial parks for manufacturing businesses, and have sought state and federal funding for the construction of roads and other necessary infrastructure. These projects have been undertaken not just to attract new businesses, but to allow existing employers to expand without leaving the area.

Another local economic development initiative is the Buy Local Program. Franklin County has shown an active desire to promote the consumption of locally grown produce and the patronizing of locally owned businesses. The effort to keep consumers' dollars in Greenfield includes the promotion of Main Street, the support of businesses that sell local goods, such as Green Fields Market on Main Street, and the creation of a "local currency" that is accepted by area businesses.

Local officials connected with economic development report that Greenfield has had difficulty attracting and retaining large commercial or industrial operations. One major reason is a lack of attractive industrial space. Most of the land in the Greenfield Industrial Park is either cannot be built or has already been developed, leaving only a few small parcels. The Redevelopment Authority is responsible for marketing these sites. As local businesses grow and their facility needs increase, they often must look out of town for appropriate space. The low population of the region means a small labor pool, particularly for highly skilled workers. Though the percentages of high school and college educated residents in Franklin County is relatively high, compared to the state and the nation, their overall numbers are small, making the labor market difficult for businesses that rely on such workers. [12]

[12] Franklin County OEDP Annual Report, 1999; Pat Smith interview.

Community Context

History of Technological Penetration into Community Economy

Any technological history of Greenfield and Orange must note that both of these towns began as agricultural communities and grew into manufacturing centers. The development and maintenance of these industries involved the transport of physical objects, both raw materials and finished products. Throughout the history of these rural communities, transportation infrastructure has played an important role in supporting their economic development. Waterways, railways, and highways have been the evolving transportation media for moving people, materials, and goods from place to place.

Recently, though, economic shifts have resulted in a decline in the value of both agricultural production and manufacturing. Except for niche markets, the economic development potential of these traditional industries has been nearly exhausted. By the mid-1990s, the idea of the information economy began to create ripples in our culture. Economic-development specialists have been quick to develop analogies regarding the similar effects of transportation and telecommunications infrastructure. Just as in the traditional economy a community's relative proximity or access to transportation infrastructure could mean the difference between economic prosperity and growth or isolation and economic decay, proximity to telecommunications infrastructure is all-important in the information age. Numerous examples document this direct relationship between traditional infrastructure investment and economic growth. This case study is among the pioneering attempts to describe an analogous relationship regarding investment in emerging communications infrastructure.

Interviews with local development officials, business leaders, and information-technology specialists in Greenfield produced an array of accounts regarding the penetration of technology into the community economy. They ranged from mild disillusionment to upbeat optimism about the current system and its economic role. Not surprisingly, the most optimistic viewpoint came from Bell Atlantic (now Verizon),

which provides the only access to the region's telecommunications technology. However, that corporation also came in for some of the sternest criticism.

Van Wood owns Small Corporation, housed in the Greenfield Industrial Park, a facility he is working to expand as a member of the Greenfield Redevelopment Authority. Wood reported that despite repeated service calls to Nynex and then Bell Atlantic, who took over the monopoly in the Local Access Transport Area (LATA) in 1996, two of his lines have been continually fuzzy for the past ten years. He explained that since there were not enough good copper pair wire connections running into the park, he was continually getting interference from his neighbor's lines. The whole system was running at full capacity, resulting in poor transmission quality. Recent upgrades to the local loop in the Industrial Park, however, have provided additional capacity.

David Leonard, the principal of ShaysNet, a local Internet service provider (ISP), had much to say about the history of Greenfield's telecommunications technology. As a provider of Internet service to local residents and businesses for the past five years, he has had regular opportunities to interact with both the physical infrastructure and the people who install and maintain it. Leonard had few positive words to say about the level of service from the phone company over the years. He described crawling through basements in downtown Greenfield to install fiber-optic connections for clients, and said it was likely that the copper phone lines he saw during the project were the original ones installed with the first telephone service in the early 1900s.

Leonard went on to explain some of the reasons for this lack of up-to-date infrastructure. As an example of the possibilities for abuse of the current regulatory structure, he related the widely circulated rumor that the executives of AT&T and its "Baby Bell" progeny, Nynex and then Bell Atlantic, had "bet their pensions" on the outcome of the company's uneven investment in infrastructure development. In what became a self-fulfilling prophecy, business development thrived in areas in which they invested, prompting more investment, which led to more development. Meanwhile, communities like Greenfield and Orange were left with original wiring and outdated mechanical switches. Leonard

speculated on a pending lawsuit in the neighboring town of Athol over a central-office switch upgrade, saying he would not be surprised if the switch, which was touted as a new-model upgrade, had actually been removed from another central office that had received a more up-to-date switch. Essentially, he said, the rural community was getting a hand-me-down from a community with the potential for a higher rate of return.

Leonard cited repeated problems with Bell Atlantic's service record. The problem, in his opinion, is rooted in a number of related issues. Repeated mergers and the resulting employee turnover result in the loss of good employees. Problems caused by poor preventative-maintenance schedules are compounded by the lack of proactive testing. Since there is no mechanism for accepting or correlating reports of problems that originate in its equipment, the company is unable to respond effectively even to repeated reports of similar problems.

Community Vision for IT and Economic Development

Given the statewide and nationwide emphasis on Internet technology as primarily an educational issue, it is not surprising that efforts to address IT issues in Greenfield and Orange have been focused on the public schools, including Greenfield Community College (GCC), where economic development issues are only beginning to come to the fore. The most extensive foray into the issues and opportunities raised by IT has been the Technology in Education Partnership of Franklin County. This organization includes representatives from GCC, local and regional school systems, the University of Massachusetts at Amherst, area libraries, the Franklin County Chamber of Commerce, the Franklin Regional Council of Governments (FRCOG), and other educational and community partners. The Partnership's Web site (found at www.tep.k14.mass.edu) is focused on educational resources for teachers, parents, and students, with an emphasis on Internet usage and other computer resources. The Partnership has worked to improve Internet access at area schools by connecting them to GCC via ISDN lines.

Of all the organizations working on planning and development, the Franklin Council of Governments has placed the most emphasis on utilizing IT as a tool for economic

development. A number of the goals and objectives in the Greater Franklin County Overall Economic Development Plan (OEDP) of 1999 deal with IT and its potential to contribute to an economically sustainable community.

Recognizing that the region's lack of telecommunications infrastructure puts businesses at a severe disadvantage, the OEDP Committee is actively seeking to involve state officials and legislators in efforts to improve the situation. A map was included in the Committee's report, showing the location of central switching facilities in the region and indicating that only the Greenfield and Amherst offices had the digital switching required for high-speed digital service. Other central switching offices are shown, to indicate the need for upgrades. The Committee also surveyed local businesses on their current and planned Internet usage, in order to determine the level of demand. Finally, the OEDP notes the importance of efforts to provide fiber-optic links to the I-91 Industrial Park in Greenfield, as well as to the Industrial Park Number 2 being developed in Orange.

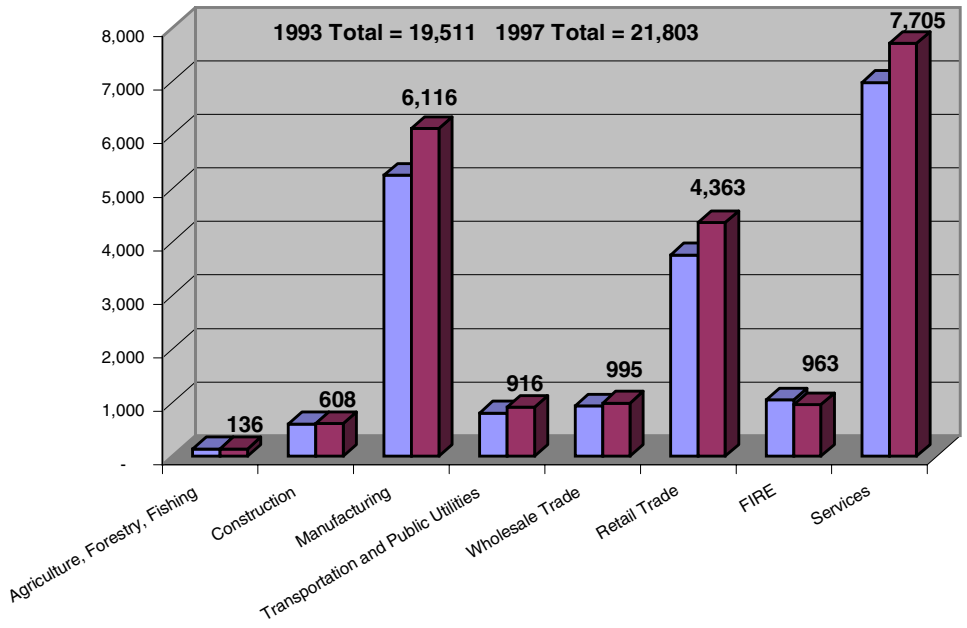
The plan also emphasizes the educational and training opportunities of the Internet, for example, the job-training potential of connecting area schools to Greenfield Community College via ISDN lines in order to facilitate job-training initiatives.

The OEDP identifies the region as having the potential to attract technology-based businesses. The area's proximity to a major university, its relatively high education levels, and the presence of several IT businesses are recognized as assets that could advance technology-related economic development. These advantages are curtailed somewhat by limited telecommunications infrastructure, a lack of appropriate space, and a lack of venture capital. The OEDP recommends utilizing traditional economic development and revitalization activities, such as the provision of incubator space and a loan pool, to nurture IT-dependent businesses.

Economic Base

Employment

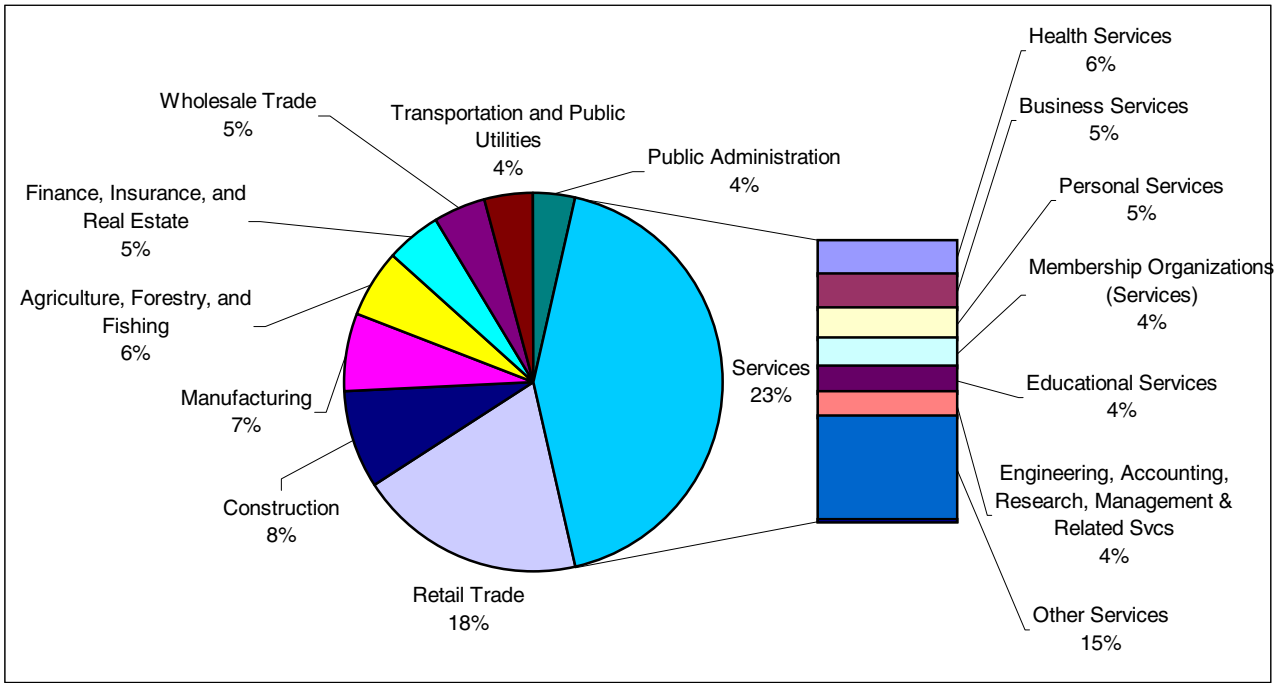
Figure 1 - Franklin County Employment Change by Major Division, 1993 to 1997



According to current marketing estimates, over 27,000 jobs are located in Franklin County, approximately 11,000 of them in Greenfield.[13] The rural town of Orange, located near the eastern end of Franklin County, also taps the employment resources of Fitchburg and Leominster. Analysis of the economic base in Franklin County by SIC divisions and two-digit SIC codes show a region in transition from traditional manufacturing and agriculture to an economic base more dominated by services, high-tech manufacturing, and trade. Current data show that the major employment divisions in the county are the service sector (36 percent), manufacturing (27 percent), and retail trade (20 percent). Since 1993, employment growth has been seen primarily in manufacturing (875 jobs), services (726 jobs), and retail (604 jobs).

[13] iMarket, MarketPlace Business Data, 1999.

Figure 2 - Businesses by SIC Division with Service Sub-Divisions Franklin County, 1999

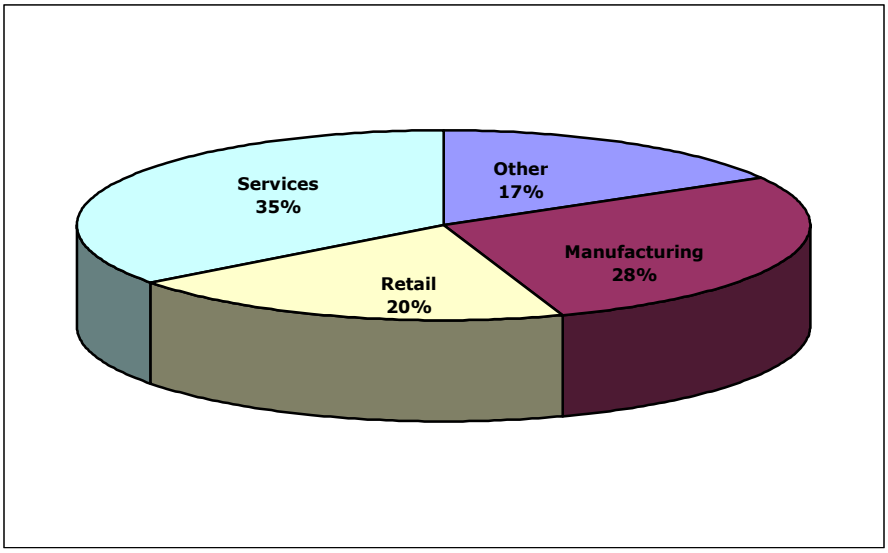


Services

As is typical elsewhere in the Commonwealth, services dominate the employment scene. Employment in the service sector has increased over time. According to County Business Patterns, employment in services rose from 6,979 jobs in 574 establishments in 1993 (36 percent of total employment) to 7,705 in 612 establishments in 1997 (35 percent of total employment). The largest clusters of employment in the service sector are health services, educational services, and social services.[14] Businesses in the county are grouped along similar lines, with service-based businesses dominating, followed close behind by retail businesses.

[14] iMarket, MarketPlace Business Data, fourth quarter 1999.

Figure 3 - Franklin County, 1997 Employment



Manufacturing

The manufacturing sector remains critical to the economy of the region, accounting for about a quarter of all jobs.[15] Data show that while the employment base in manufacturing has actually increased, from 26.8 percent of employment in 1990 to 28.1 percent in 1997, the number of manufacturing establishments has decreased, from 140 in 1990 to 127 in 1997.[16] The Greater Franklin County OEDP report confirms that in spite of apparently stable overall employment numbers in manufacturing, the region has suffered repeated shocks to its manufacturing base, in the form of plant closures and layoffs, which are continuing today.

The town of Orange, at the eastern end of Franklin County, was passed by in the first wave of defense-initiated technology development and suffered a significant setback with the closing of nearby Fort Devens. While manufacturing appears to have remained strong

[15] 28.1 percent in 1997, according to 1990–1997 County Business Patterns, U.S. Department of Commerce (cited in Franklin County OEDP Annual Report, 1999), and 21 percent, according toMarket, MarketPlace Business data, 1999.

[16] County Business Patterns, 1997.

in the town itself, declining from 37.2 percent in 1985 to 34.5 percent in 1998,[17] close to half of this employment came from the two largest manufacturing firms in town, Rodney Hunt Company and Catamount Manufacturing.[18] This puts Orange in the same vulnerable position as the majority of rural towns with functioning manufacturing plants—disproportionately dependent on these large employers. However, in the case of Orange, it makes more sense to focus on the job base in the broader region, since local employment represents only a small fraction of the total base available in the county.

IT-Related Business and IT-Dependent Business

While a look at traditional categories of employment gives a sense of the kinds of economic activity in the area, it does not indicate how businesses are involved with information technology. In order to do this, we identified firms in the region that are part of the information technology cluster itself. We also identified businesses known to be heavily dependent on information technology services. The existence of these types of businesses can be read as an important indicator of IT activity in a region and a predictor of future demand for IT services.

According to recent work on the subject of e-commerce, some businesses act as critical drivers of information technology in the economy. Four clusters of activity not only will do well in the Internet-dependent economy (including e-commerce), but will lead the way. Those industries are (1) consulting services, (2) infrastructure providers, (3) software developers, and (4) financial services.[19]

According to recent marketing data,[20] Franklin County has 138 businesses and 1,220 jobs in these clusters: 36 consulting firms, with 113 employees; 14 software developers, with 47 employees, 40 infrastructure providers, with 343 employees, and 48 financial-service providers, with 717 employees. Significantly, these businesses appear to be clustered where information technology infrastructure options and services are most available and

[17] DET Local Data, ES 202 series.
[18] DHCD, Massachusetts Community Profiles.
[19] Ball, Milne, and Milne, "Measuring Internet Presence" (1999).
[20] iMarket, MarketPlace Business Data, 1999.

reasonably priced, that is, within the town of Greenfield itself. Forty-two percent of Franklin County's information technology–intensive business are in Greenfield (see Table 1).

It must be noted that this cluster of IT-related firms in the county is relatively small, representing only 4.7 percent of all businesses and 4.5 percent of all employment in the county. Both Hampshire and Hampden counties have higher proportions of these jobs relative to their entire job base (see Table 2). The numbers suggest a broader regional disparity, which could be related to more favorable conditions for business-related information technology in the counties to the south. As these tables show, IT-intensive businesses and employment appear in the highest proportions in Hampden County, the hub of IT infrastructure and services in the region.

Table 1

Information-Technology-Intensive Jobs by County, 1999

It appears that these jobs are geographically sensitive

	Number of Businesses	% Businesses in the County	Number of Employees	% Employment in the County
Franklin	138	4.7	1,220	4.5
Hampshire	355	5.9	2,700	5.0
Hamden	951	6.3	12,845	7.4
Total	**1,444**		**16,765**	

Source: IMarket, Inc.

Similarly, Hampden County contains more than its relative share of IT intensive business and significantly more IT-intensive employment than Hampshire and Franklin counties. Hampshire and Franklin counties lag behind in direct proportion to their distance from the Springfield hub (see Table 2), putting Franklin County the furthest behind of the Connecticut Valley counties in IT-related business activity.

Table 2

Regional Business and Employment by County, 1999

	Businesses		Employment	
	% Total	% of IT Total	% Total	% of IT Total
Franklin	12.2%	9.6%	10.70%	7.3%
Hampshire	25.0%	24.6%	21.10%	16.1%
Hampden	62.8%	65.9%	68.20%	76.6%
	100.0%	100.1%	100.00%	100.0%

Source: IMarket, Inc.

Within the county, IT jobs are concentrated around Greenfield and Deerfield. Both these towns are located beside I-91. In 1999, Orange had 34 IT jobs. Although this is a considerably smaller number than the previous towns, it is a larger number of IT employees than many other towns in Franklin County (see Map 1).

Map 1

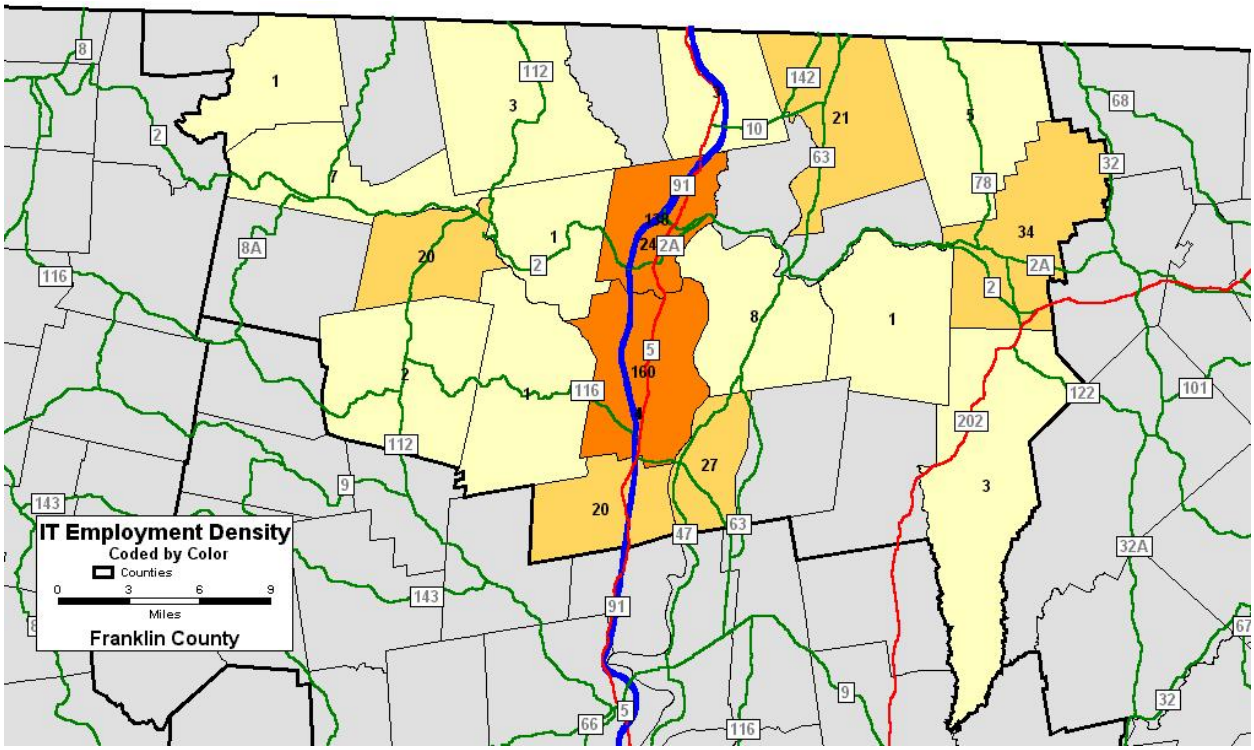
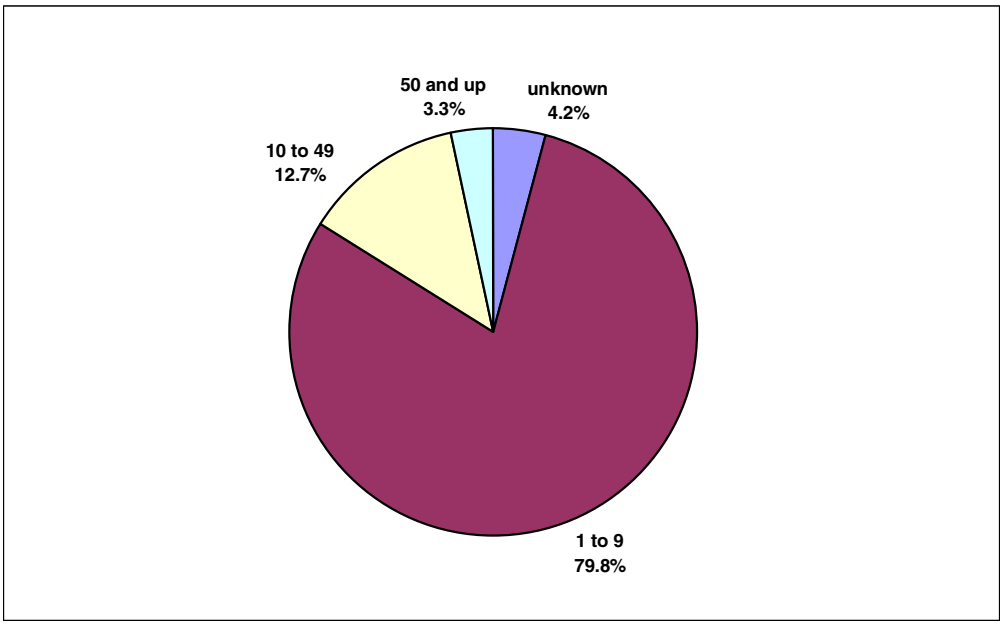

IT Employment Density
Coded by Color
Counties
0 3 6 9
Miles
Franklin County

Figure 3 - Business Size by Number of Employees Franklin County, 1999



Source: IMarket, 1999

Firm Density and Size

Because of historical development patterns in the region, the majority of businesses in Franklin County are clustered in Greenfield and in a few other town centers. The prohibitive cost of wiring to dispersed locations means that wire and cable-based Internet service is slower and more expensive for businesses and households outside of Greenfield center.

The predominance of smaller firms in the region presents a challenge to building recognizable market demand for Internet services. According to marketing estimates, most firms in the region are small —80 percent of all firms have between one and nine employees; only 3.3 percent have more than 50 employees.

Labor Force

Labor force trends in the region reflect its economic difficulties, which, in turn, affect the region's ability to generate market demand. Recovery from the recession of the early 1990s has been slower than the in state as a whole. According to household-based data, employment and the labor force in the county have only recently surpassed 1989 peaks.

Unemployment rates, which rose to 8.1 percent during the recession, are now as low as state rates.

Figure 4 - Franklin County Unemployment Rates, 1989-1998

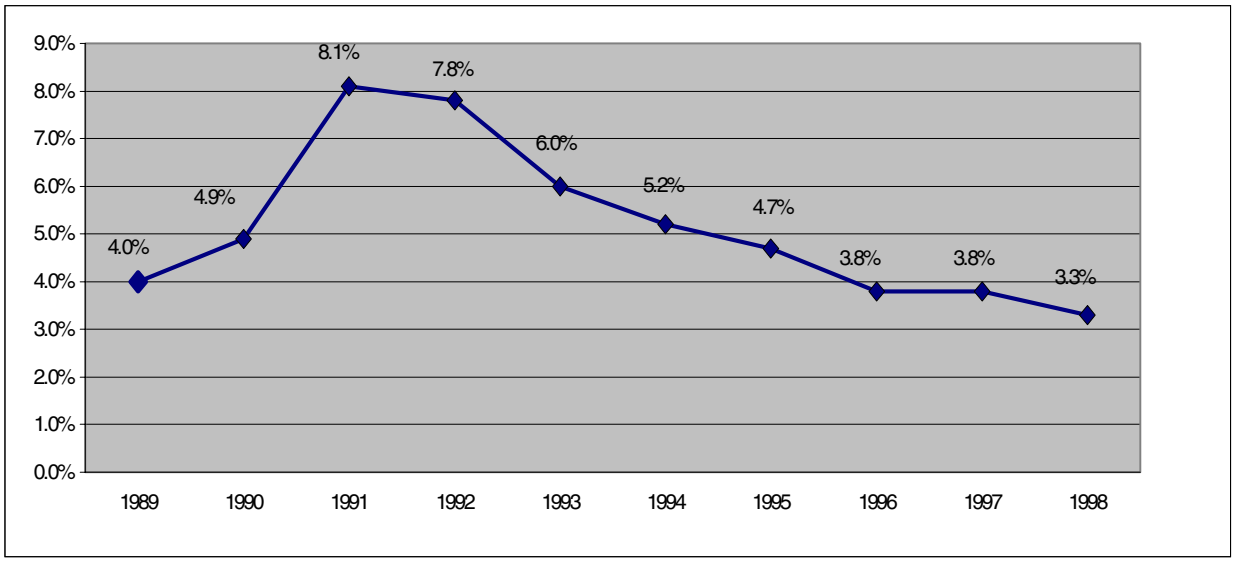
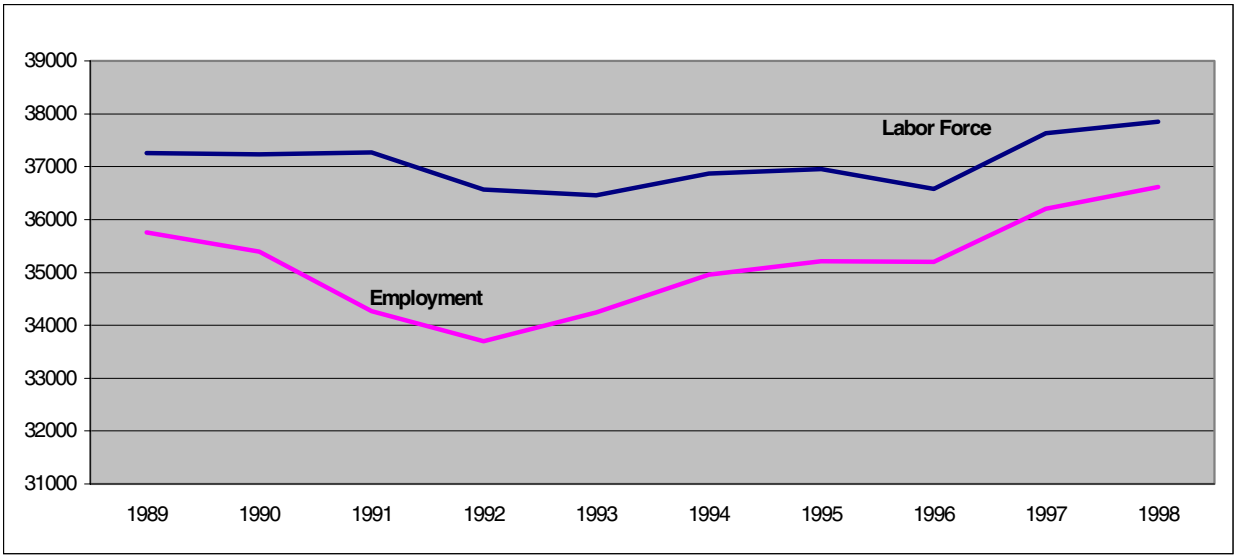


Figure 5 - Franklin County Employment and Labor Force, 1989-1998



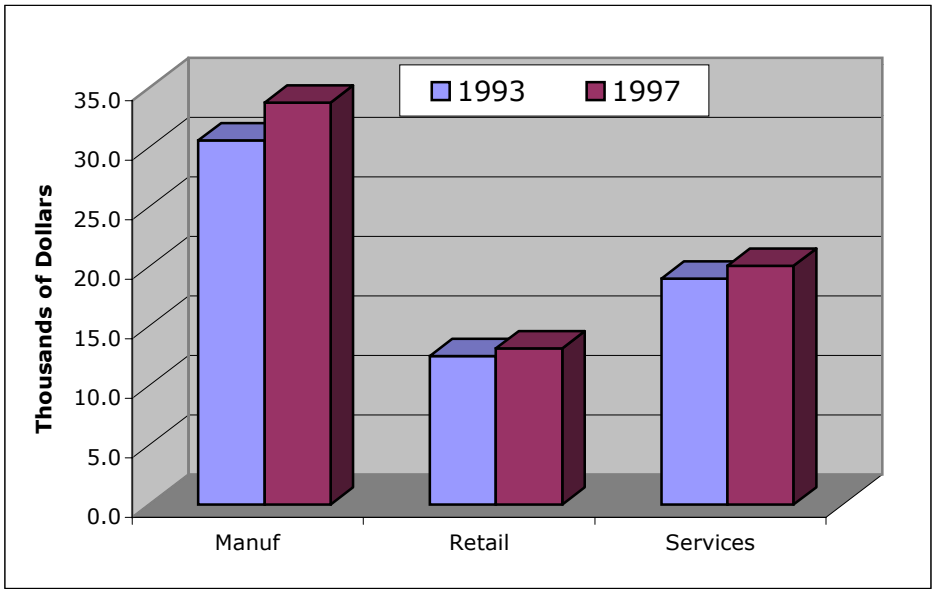
Source: Massachusetts Division of Employment and Training, LAUS series

Income and Wages

In spite of stable employment and labor-force trends, data suggest that the region is still behind the state in personal income and in wages per job. The Franklin County area continues to struggle to retain and attract higher-wage jobs. Manufacturing employment has increased since 1993 and wages have grown by 10 percent since that time. At the same time, however, lower-paying service and retail jobs now make up over 55 percent of employment, and wages in these areas have increased only 5 to 6 percent since 1993.

Large discrepancies exist between manufacturing jobs and service and retail jobs: wages in the service sector (35 percent of all jobs) under-perform manufacturing wages by almost $14,000 annually, and wages in retail (20 percent of all jobs) under-perform manufacturing wages by almost $21,000 per year.

Figure 6 - Franklin County Average Annual Wages, 1993 and 1997



Source: County Business Patterns

The consequences of the shifting industry mix in the economy, as well as relatively low wages and salaries in the area, are reflected in lower per-capita personal incomes and lower average earnings per job. Per-capita personal income in Franklin County is the lowest in the state (see Table 3).

Table 3

Personal Income and Per Capita Personal Income, 1995–1997

	Personal Income (millions of dollars)				Per-Capita Personal Income (dollars)			
				% Change				County Rank
	1995	1996	1997	96-97	1995	1996	1997	in MA (1-14)
United States	6,059,091	6,408,103	6,770,650	5.7	23,059	24,164	25,288	*
Massachusetts	170,211	179,998	191,008	6.1	28,097	29,591	31,239	*
Metropolitan Portion	168,077	177,727	188,610	6.1	28,167	29,664	31,317	*
Non-metropolitan Portion	2,134	2,271	2,398	5.6	23,538	24,795	26,115	*
Franklin County	**1,517**	**1,603**	**1,682**	**4.9**	**21,418**	**22,561**	**23,779**	**14**

Source: Bureau of Economic Analysis, Regional Accounts Data

As can be seen in Table 4, average earnings per job are far lower in Franklin County than in the state as a whole.

Table 4

Per-Capita Personal Income and Average Earnings Per Job

Mass and Franklin County, 1997

	MA	Franklin County
Place of Residence Profile		
Population (number of persons)	6,114,440	70,749
Per capita personal income (dollars)	31,239	23,779
Per capita net earnings	20,856	14,602
Per capita transfer payments	4,774	5,032
Per capita dividends, interest, & rent	5,609	4,145
Place of Work Profile		
Total Earnings (place of work, $000)	139,516,152	879,184
Average earnings per job (dollars)	35,563	24,038
Average non-farm proprietors' income	21,735	13,610

Source: Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income

Level of Technology

The network of telecommunication connections has been called the information superhighway, and for good reason. Not only is this information network analogous in structure and mechanics to transportation and other forms of infrastructure, but access to it is becoming as vital to economic development as access to roads, electricity, sewerage, and solid-waste disposal. However, for a number of reasons, assessing a region's information technology and coming up with a measurement of its adequacy is far more complicated than assessing the infrastructure needs of any of the more traditional industrial and commercial sectors. As described in the next section, determining the role that different levels of technology play in economic development efforts is even more difficult, because of the complexity of the factors involved.

One reason that defining adequacy is difficult is that information technology is effectively "invisible," especially for the layperson or nontechnician. Assessing telecommunications infrastructure requires more expert observation and technical knowledge. While a network connection or a switching hub might look to the untrained eye to be just a mass of wires and computer hardware, the channels that carry information are understood and discussed by experts in complex technical jargon and numbers, followed by units specific to the field. To make matters worse, the accelerated rate of technological innovation ensures that these difficult terms are constantly changing.

At the very least, to determine an adequate level of information technology in Greenfield and Orange, one must be able to determine the flow of information across the telecommunications infrastructure. *Bandwidth* is the measurement used to describe the amount of data (digital information) that can flow through a telecommunications line in a given amount of time, usually seconds, e.g. 56.4 kilobytes/second (Kbs). The primary unit of measurement for digital information is the byte (made up of a string of eight bits or 1's and 0's). A kilobyte (Kb) is a thousand bytes (1,000), a megabyte (Mb) is a million bytes (1,000,000), and a gigabyte (Gb) is a billion bytes (1,000,000,000). A one-page word-processing file averages about 30 Kb. Web pages without pictures vary

considerably but fall in the range of 1-25 Kb. Depending on resolution and dimensions, a single picture can be as high as 120 Kb.

Furthermore, since communications service is a resource necessary for doing business, the cost of different levels of technology is an important factor in determining its adequacy in Greenfield and Orange. A number of sources, notably Bell Atlantic/Verizon, have identified this aspect of service as the most important factor in the digital divide. A dial-up connection using the "plain old telephone service" (POTS) currently provides the most reasonable rates to most companies in Greenfield and Orange, especially those in the industrial parks, which are too far from the downtown switching offices to currently be provided with higher levels of technology. Each phone line a company pays for delivers approximately 28.8 Kbs bandwidth from a dial-up connection to the Internet, which currently costs an additional $20–30 on top of the basic phone service charge of $30–40. This narrow, relatively expensive bandwidth can result, as one Greenfield Industrial Park tenant reported, in a 10- to 15-minute download time for a 15 Mb file —a very long wait for one comparatively small file. If anyone else in the office tries to send or receive e-mail or view web pages during this period, the download time of the original file will increase and the new user's Internet interface will be slowed. In addition, performing this task will tie up a telephone line for the duration of the use. Clearly, this is an inadequate level of technology for the coming information age, in which companies can expect instantaneous data transfer.

This is not to say that Greenfield and Orange need to have a telecommunications infrastructure that rivals Boston's or New York's, just that their level of service ought to provide them access to economic development opportunities now and in the future. The provision of telecommunications infrastructure is undertaken by private companies that are in business to make a profit (a right guaranteed in the deregulated industry), so unless public pressure or incentives are applied, investment is more likely to be made in areas with large populations or, even more important, those that are densely settled. The formula telecommunications companies used to determine where to install the newest technology is based on the number of people potentially served by the technology, a

practice termed Density Related Costing. To level the telecommunications playing field for rural and less densely populated urban areas like Greenfield and Orange, thereby promoting their economic development, a method is needed to relate jobs to infrastructure capacity.

Based on the figures in the following table, the minimum constantly connected bandwidth for a company that uses the Internet for business is 5–10 Kbs per person. For a company or group of companies employing 150 people, this translates to a connection of 1.5 Mbs, approximately the level of service that a Full T1 line provides. The technology allows for splitting this type of line into smaller bandwidths, called Fractional T1 lines, that can be apportioned among a cluster of offices in the industrial parks or in downtown Greenfield or Orange. Therefore, a Full T1 line is currently a safe standard for the retention or creation of 150 information technology–related jobs, not necessarily all with the same firm, in Greenfield or Orange.

Table 5: Levels of Capacity

Power Level	**Bandwidth**	**# of Full Time Jobs**	**Business Use Characteristics**
Dial-up	12-–56 Kbs	1-–2	- Access Web infrequently - E–mail infrequently - Speed of transfer unimportant - Simultaneous use of phone and Internet not necessary.
ISDN	112 Kbs	2–24	- Occasional use of web - More frequent email use - Need ability to use phone and Internet simultaneously.
Emerging (DSL)	144—256 Kbs	Up to 25	- Access the Web occasionally - E-mail or transfer very few large files and documents

			- Do not host own Web site
Growth (DSL)	384-– 512Kbs	Up to 75	- Have many people simultaneously accessing the Web - E-mail or transfer large files and documents - Host own Web site
Mission-Critical (DSL—T1)	768Kbps-– 1.54Mbs	Up to 150	- Rely on the Internet to conduct business - Have many people simultaneously accessing the Web - E-mail or transfer large files and documents - Host own Web site

Source: Based on HarvardNet Business SpeedDSL Power Level Chart
http://www.harvardnet.com/infocenter/dslbest.phtml

Current service availability in the Franklin County region includes ISDN lines, geographically limited to an area within 18,000 feet of the switching office in Greenfield center. DSL is not yet available in Greenfield or Orange; Verizon (Bell Atlantic) plans to provide it this year. T1 lines are subject to long-distance rates.

Current Infrastructure in Greenfield and Orange

The local loop, operated by Verizon, the Incumbent Local Exchange Carrier (ILEC), connects the end user to the larger global network through switches in the center of each town. Currently Greenfield and Orange have local loops made up of twisted pair copper phone lines. The switch that interfaces with the regional backbone in Greenfield has recently been upgraded to fully digital, capable of providing state-of-the-art service within a limited area. The upgrade allowed for the provision of touch-tone service for the first time since it's the installation of the infrastructure. Without this basic upgrade, even a dial-up Internet connection, which relies on tonal communication between computer

modems, would not have been possible. The switch in Orange, on the other hand, though it can provide tone service for dial-up connections, is not currently capable of providing high-speed connections such as DSL and ISDN.

High-speed connections such as DSL, ISDN, and T1/T3 lines are dependent on both the quality of the switch in the central office and the user's proximity to it. Currently, the switch in downtown Greenfield can provide T1, ISDN and Frame Relay to users within a range of 18,000 feet (3.4 miles). As a first step in their effort to gain adequate access to high-speed connections at reasonable rates, the Franklin Regional Council of Governments has developed a map that shows the location and type of central office switches throughout the county, as well as an approximate range of service. According to the map, only Amherst and Greenfield currently have high-speed (ISDN) connection capability. Orange and the other towns in the county would need upgraded switches to receive high-speed service.

According to Verizon, the story is quite different. It is important to mention here that as the Incumbent Local Exchange Carrier (ILEC) currently working to obtain permission to provide long distance service in the county, this company has an interest in fostering an identity as a "good corporate citizen." According to Mike Pequignot, Bell Atlantic's public relations representative, (now Verizon), Greenfield currently has a state-of-the-art, fully digital switch in its central office, and. fiber-optic lines have been run throughout the county in strategic locations. According to this assessment of infrastructure, the same service is available throughout the county. Several T1 lines and even T3 lines already run in and out of Greenfield, leased by private companies.

Service Providers and Competition

Verizon, as the ILEC in both Greenfield and Orange, is currently the only provider of telecommunications service in either of these towns. Hence, it owns the only switches, or connections, to the larger network. This monopoly position allows the company to provide any level of service as long as the cost and quality meet minimum standards set by the Massachusetts Department of Telecommunications and Energy (DTE).

Effectively, no one is competing to provide the best service at the least cost, and testimonies of various users are less than complimentary.

Currently, one set of regulations prohibits Verizon from providing long-distance service and another regulation defines high-speed Internet connections as a form of long-distance service. This forces Verizon to pass this aspect of the communications business on to companies such as AT&T, MCI, Sprint, and others who have permission to provide such service. All these companies have located their operations in Springfield because of its higher density of users and therefore greater profit potential.

This situation creates two issues that affect the economic development potential of Greenfield and Orange. First, and of immediate consequence, is that high-speed Internet connections leased to businesses in these towns are subject to mileage fees to Springfield that make them prohibitively expensive except for the largest companies. Secondly, since Verizon is currently trying to gain regulatory permission to provide high-speed Internet connections in these towns, where they have no competition, they have a vested interest in presenting the best possible picture of their current service. They would rather not have the government decide that promoting competition in these areas would be the most effective policy.

Ultimately, the political decision of which company is allowed to provide which level of service is likely to be in Verizon's favor if it can create a good impression of the level of service it can provide. Now that the demand for better service is beginning to give rise to coalitions that are gaining influence, Verizon insists that the current infrastructure, which it owns and operates, is not the problem. Rather, it is the regulatory structure that keeps it from taking full advantage of its monopoly status in Greenfield and Orange. According to Mike Pequignot,[21] fiber-optic lines are already in place throughout the county and can provide any level of service to anyone willing to pay for it. Within a reasonable amount

[21] Michael Pequinot interview, Fall 1999.

of time, additional spurs can be run off the strategically placed existing lines and all areas can be connected. The high costs are due to the regulatory structure and the long-distance providers who set the prices.

Documented proof of Franklin County's infrastructure is hard to come by. Verizon is currently developing a map, But even when it is complete it will not be readily available. First of all, it contains proprietary information on the strengths and weaknesses of the company's potential markets that would be very useful to competitors. Second, the map's large size and hard-copy format (on a 6' x 8' roll) makes its distribution impracticable. Without this key information, establishing a case for the need for a Competing Local Exchange Provider (CLEC) is difficult if not impossible to make.

Potential for Economic Development with Existing Infrastructure

Just as the current level of technology is difficult to define because it is based on a hierarchy of infrastructure—the availability and cost effectiveness of which is dependent on the user's proximity to existing points of presence—the economic development picture is even more difficult to define. Currently, the more remote small urban and rural areas are far from affordable high-speed connections. Since statistically significant, mutually supportive relationships between highly developed economies and higher-level infrastructure have already been established, the challenge now is to establish these relationships in current disadvantaged areas.[22]

According to the Social Construction of Technology (SCOT) approach advocated by Zenia Kotval and other experts on the nexus between telecommunications and economic development, the interplay between the many different factors involved makes causality almost impossible to determine. As Stephen Graham and Simon Marvin write:

> Technological development is thus a profoundly social and political process, not a predefined one. The urban effects of telecommunications are therefore indeterminate—the aggregate results of countless individual examples of the social construction of technology. This means also that it is

[22] Kotval, "Telecommunications: A Realistic Strategy" (1999).

> impossible to define single, all-encompassing "impacts" of telecommunications on cities in some deterministic fashion. It also means that suggesting there is some single "trajectory" of telecommunications-based urban development which is driven by the political economy of capitalism is equally false. The SCOT approach implies that the ways in which telecommunications relate to urban change is likely to vary in time and space in complex ways. Analyzing the process whereby telecommunications are socially constructed, however, is difficult to achieve. This is because identifying simple chains of cause and effects is made inappropriate by the complexity of these society-technology relationships.[23]

The role that inadequate infrastructure plays in the digital divide is further obscured by the pace of change in the industry.

Users of Technology

Business Users

Greenfield and the surrounding area contain a number of businesses that are dependent on Internet usage and advanced telecommunications. These businesses can be divided into three categories: (1) large operations with substantial data transfer needs, (2) small IT businesses located on or near Main Street, and (3) traditional businesses that have begun to integrate IT applications into their operations.

Critical users can also be categorized geographically, since location within the county significantly determines a business's access to service, as well as its speed and cost.

Businesses With Their Own T1 Lines

The largest information-dependent businesses in the region, such Franklin Medical Center in Greenfield and Channing-Bete in Deerfield, contract with Verizon for T1 service. The cost of installing the hardware and software infrastructure necessary to connect the user to Verizon's powerful central switching resources in Springfield makes this option feasible for only the largest businesses.

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[23] Graham and Marvin, *Telecommunications and the City* (1996), 106.

The largest employer in Greenfield, the Franklin Medical Center, depends heavily on information technology for its medical and administrative operations. The Medical Center's 33 area sites, including offices, primary-care centers, and member doctor's offices, are linked via two intranet T1 lines, leased from Verizon, to the phone company's headquarters in Springfield. These resources allow the sharing of medical information among health-care providers and staff. Voice reports, text, and pictures can be transferred throughout the region. Patient records can be accessed from anywhere within the network. All locations on the network are on an intra-office five-digit-dialing telephone system. Given the power of this system, Franklin Medical Center could be expected to be satisfied with the IT resources in the area. However, its ability to conduct business on line is limited by inadequate home-based access throughout the region.

The Medical Center is in the midst of preparing a technology plan that will envision a greater role for telemedicine. This plan requires high-speed access to allow the transmission of pictures and large amounts of data, which is not feasible at the current level of residential service. The Medical Center also operates a large home-care network. Visiting nurses and home-health aides are provided with laptop computers to allow access to the central resources. Once in the patients' homes, however, the health care providers are dependent upon the local POTS network. The slowness and lack of a dependable connection severely limit their ability to bring their considerable technological resources into service for home-care recipients.

Businesses within Reach of ISDN Service: Downtown Greenfield

The historic pattern of locating telecommunications equipment downtown has proved a boon for Main Streets throughout the state, since the cost and availability of service is determined by the distance of the user from the provider's switching facility. The availability of inexpensive office space, as well as intangibles related to a presence in a vibrant downtown (restaurants, shops, historic character, public visibility, and the opportunity for face-to-face contact with other businesses), also serve to make this area attractive to the small IT companies.

Downtown Greenfield has developed a mini-cluster of small IT businesses, which are dependent on the ISDN service available from Verizon's switching facility on Main Street**.**. There are roughly 14 IT businesses in Greenfield (the speed of the digital revolution and the difficulty of settling on definitions makes exact numbers impossible to pinpoint), most of them small service providers located on or near Main Street. Several Internet service providers (ISPs) serve clients throughout the region, primarily private households. Many of their clients live in the communities to the south of Greenfield. The presence of the University of Massachusetts in this area is a likely reason why demand for Internet services is greater than in other rural areas.

Crocker Communications is the largest IT business in Greenfield. The company began as a telephone-answering service about 30 years ago and has expanded into other telecommunications-related activities. In the early 1990s, the company began offering Internet access and designing Internet systems. Today, the company maintains offices in downtown Greenfield and in Northampton. Crocker hosts the Greenfield city web page.

Businesses Beyond the Reach of ISDN Service: Industrial and Commercial Sites out of Downtown

Another important set of users in Greenfield is the larger industrial and commercial facilities. Most of these users, such as those located in the I-91 Industrial Park, are located away from downtown, making ISDN service either expensive or unavailable, so most of the employers in Greenfield depend on POTS). Businesses in the Industrial Park utilize the Internet for research, communication with other businesses, sales, and marketing. A number of these businesses have web pages, which they use for marketing, public relations, or sales. Many use the Internet for e-mail, information gathering, and business-to-business communication.

Located at the junction of Route 2 and I-91, Greenfield's Industrial Park is home to 17 businesses employing a total of 550 workers. Its total payroll is $19 million, making the average salary of Industrial Park workers considerably higher than that of their counterparts in the town and the region. While there is clearly an appreciation of the

importance of a web presence for non-IT companies, the desire of the park's residents to take advantage of the opportunities is limited by infrastructure.

The copper lines serving the park severely limit the bandwidth available to its tenants. Only rarely can speeds greater than 28.8 Kbs be achieved. One business owner reported that his company often sends and receives detailed technical drawings via e-mail. At this time, this "sluggishness" is an inconvenience; but if the situation is not improved, it could in the near future become a severe handicap for the park's tenants, as well as for the Redevelopment Authority's attempts to find occupants for the remaining space, retain tenants, and replace departing businesses.

The I-91 Industrial Park has suffered for years from bad telecommunications infrastructure. Service greater than POTS is currently not available in the park, because the lines and hubs are not sufficient to handle high-speed data transmission. Verizon has begun the process of installing a fiber-optic system to the park, but the completion of this project is being held up. MassHighway intends to reconfigure the intersection of Route 2 and I-91, and until this construction is completed, the fiber-optic cables cannot be extended into the park.

Potential Business Users

A number of sectors of Greenfield's economy have yet to take advantage of recent IT innovations, either because of inadequate knowledge, the cost of service, or infrastructural deficiencies. Despite its relative success at retaining its retail base, downtown Greenfield faces an uncertain future. The town was successful in its recent attempts to keep Wal-Mart from locating by the highway, thus maintaining downtown's share of retail business. However, Greenfield cannot expect that commercial strip development of this sort will avoid the region forever. So far, the city has been successful in maintaining a critical mass of business activity in the area. None of the economic development initiatives related to downtown have incorporated IT as a strategy, and few downtown retailers have created a web presence, either for advertising or for e-commerce. Given the availability of office space, the quality of life in downtown, and the

availability of IT resources, attracting additional IT-dependent businesses to Main Street and the surrounding area could be achieved.

The use of wireless facilities to transmit data may become an additional advantage for downtown Greenfield's attempts to attract IT businesses. One transmitter can provide coverage to any location within its line of sight. The compact, urban scale of the area around Main Street makes it easy to locate the entire downtown within the coverage area of a wireless transmitter, as the local ISP ShaysNet has done.

The Use of Web Sites for E-Commerce

While many of the manufacturers in the region have incorporated the Internet into their operations, many have not. Approximately half the tenants of the I-91 Industrial Park have web pages. The largest manufacturer in Orange, Rodney Hunt Company, maintains a web page to market its water-control devices and to assist potential customers in designing and engineering water-control systems. The second-largest industrial business in Orange, Catamount Manufacturing, Inc., does not have a web presence. Because manufacturing companies in the Northeast are increasingly relying on national and international suppliers and markets, an interactive web page is quickly becoming a necessity within this sector.

The largest IT business in Orange is actually a manufacturing facility for a national telecommunications company. While advanced telecommunications are not a part of the local branch's operations, its ownership by a large, IT-dependent company makes adequate Internet connections a necessity. Communities that wish to attract subsidiaries of national or international companies will be at a disadvantage if sufficient bandwidth is unavailable or if the cost of the service is prohibitive.

Public Users

There are two Web sites for the city of Greenfield itself. The Town Hall web page (www.townofgreenfield.org) is operated by the Town Manager's Office. This page is primarily useful for those doing business with the local government. Very little

information related to economic development or IT is present on this page; however,. links are provided to other pages that address these issues. Another page (www.crocker.com/greenfield) hosts the pages of local businesses and organizations and contains a great deal of information related to Greenfield's IT and economic-development initiatives. The page contains links to a hardware and software vendor, three ISPs, and half a dozen web-page designers. The Industrial Park's web page is also on this site, where companies that are considering locating here can access information about the park and available parcels. Approximately half the businesses in the park have links on this page, as does the realtor. Pages on the Greenfield site also direct viewers to local restaurants and recreational and cultural opportunities.

The Greenfield Chamber of Commerce also maintains a web page (www.co.franklin.ma.us). This page includes information about, and links to, businesses in and around Greenfield, with an eye toward the tourist or visitor looking for places to visit. No information on IT issues or opportunities is provided on this page.

Local Public Policy

Public policy regarding telecommunications has begun to take shape, mostly at the county level. On May 19, 1999, the Franklin Regional Council of Governments helped organize The Greater Franklin County Telecommunications Forum. This forum brought together the various stakeholders in the region's development of greater access to information technology. Representatives came from businesses who use the technology and those that provide communications services. The idea was to determine the level of infrastructure in the region and its adequacy, as perceived by the users.

Out of this forum came the ideas to map the current infrastructure and to focus on the tariffs filed with the Department of Telecommunications and Energy by Verizon. These efforts are still in the beginning stages, largely because the difficulty of finding the necessary information proved greater than anticipated. Currently, even the owner of the infrastructure, Verizon, does not have an up-to-date map, though one is being developed (see above). Regarding the tariff issue, a call to the Massachusetts Department of

Telecommunications and Energy revealed that there is no structure for the approval of tariffs. Companies that would like to provide service simply have to fill in the forms and submit them to the agency, which then either approves or rejects them. The basis for the individual decisions on approval or rejection is an area in need of further research. It is likely, however, that the political process involved may prove difficult to document.

Meanwhile, plans are moving ahead at the Franklin Regional Council of Governments (FRCOG) to prevail upon state legislators to provide funding for a project modeled on the successful Berkshire and Cape Cod Connect initiatives sponsored by the Massachusetts Technology Collaborative (MTC).

Peggy Sloan, Director of Planning and Development at FRCOG, outlined some of the differences and similarities between these projects. While the Cape and the Berkshires have some big users on their organizing committee, Franklin County has very few located within its boundaries. This lack of leverage is likely to be a significant barrier to progress. The overall goal of the Franklin County Project is to get all the downtowns in the region wired and connected to the regional backbone in Springfield.

Sloan described a few scenarios for the accomplishment of this goal. Once the needs have been identified through a user survey and an engineering study of current infrastructure and the possibilities for upgrading it, the ideal situation would be for a private vendor to step in and begin the work. This would avoid the difficulty of obtaining and allocating public funds. Although most people hope that this scenario can be avoided, the use of public funds, in the form of a bond, is the second choice. If tax dollars were used to develop stronger local infrastructure, the issue of ownership and maintenance would become very important. The administrative burden of these tasks, as well as the actual act of costing and providing service, are roles that Sloan says are best left to the private sector.

The role that planning officials and town governments will play in this process is still undefined. Currently, because of recent resignations, the town of Orange is without a

planner or an economic development specialist. These vacancies, however, offer an opportunity to bring a fresh perspective and renewed energy to the town's development. In a very political process, the right people may help to advance the common goals of underserved communities.

As the most urbanized section and seat of the county government, the town of Greenfield is in the position to play an influential role in the process of bridging the digital divide. While reference is made to the role of telecommunications in the town's development plan, not much action has yet taken place. This is hardly surprising, since the town is beset with a multitude of pressing issues—from efforts to revitalize the downtown retail district to redeveloping brownfield sites such as the Greenfield Tap and Die building.

Nevertheless, all the elements of a strategy to promote telecommunications as an economic development tool are scattered throughout the plan. Identifying and fostering opportunities for synergy between the stated goals could provide direction. For instance, the goal of developing a promotional image brochure to attract new businesses could be supported by goals such as increasing the awareness and support of existing businesses and the strengthening of infrastructure. All of these goals could be tied together under the county strategy to improve telecommunications service. Connections between FRCOG and the Greenfield Planning Department are strong, so the likelihood of significant collaboration is high.

Lessons and Recommendations

Of all the activities mentioned above, the most important is following up on the public forum to influence state legislators and regulatory officials at the Department of Telecommunications and Energy to encourage Verizon to upgrade service. As the Incumbent Local Exchange Carrier, with a monopoly on the provision of telecommunications service, the company will play an important role in the direction of technological development in the region. Ensuring that it acts in the public interest is the

greatest challenge and perhaps the best opportunity for Franklin County's economic future.

Currently, Verizon is seeking regulatory permission to provide long-distance service from Greenfield to compete with providers in Springfield. Linking this permission to service upgrades could provide the incentive necessary to bridge the digital divide. This simple strategy of offering the "carrot" of expanded profits could be made even more effective if a punitive "stick" is available in case the necessary reinvestment of funds is not forthcoming.

Based on discussions with David Leonard of ShaysNet, further investigations into wireless technologies as an alternative local loop are warranted. Leonard pointed out the small, unobtrusive antennas he uses to provide high-speed connections for clients in line-of-sight. A one-foot-tall white plastic-encased antenna that resembles a candle is mounted in the eaves of the building that houses this local Internet service provider. These devices already provide portable Internet access at T1 speeds. Advances in technology are always progressing, and the most cost-effective method of creating an alternative to the current infrastructure may indeed be wireless.

As described above, efforts to exploit the possible interactions and overlaps between IT and existing economic-development strategies, such as downtown revitalization and brownfields redevelopment, are necessary. The complex nexus between these issues is best utilized by efforts to strengthen all aspects. While working to improve the existing infrastructure, development officials need to begin to aggressively promote Greenfield's IT capabilities to attract new businesses. Part of this effort includes promoting downtown Greenfield as a growing IT cluster and using the Internet to showcase the ways that existing businesses utilize the region's communications options to enhance their competitive advantage. Placing information about IT opportunities on the Greenfield and Franklin county Web sites, similar to the way Springfield markets itself as a telecommunications hub, is perhaps the quickest way to reach potential new businesses looking to locate in Western Massachusetts.

Finally, involving business leaders in this process is essential. Encouraging the Chamber of Commerce to get involved in the development of an organization to allow area IT businesses to engage in collaborative action would produce many benefits. For example, networking among the many small users of IT would serve to increase their collective political power. Through collective bargaining, bandwidth sharing, and other efforts, lower access costs to communications could be negotiated in a manner similar to the energy pool that provides discounted energy rates for participating Chamber members. Increased contact and collaboration between local IT businesses could serve as a vehicle for promoting increased public awareness of their activities, thereby attracting more involvement and building influence.

The efforts in Franklin County to develop these types of collaborations are well on their way. Greenfield is sure to play an influential role in the process. Orange's involvement is less assured, but new energy in town leadership may invigorate collaboration efforts. The debate over the digital divide is alive in these towns, and so it is likely that efforts to bridge it will be effective.

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Case Study:

Lynn

Contents

Introduction

> At the dawn of the twenty-first century, the telecommunications industry has a leading position in the world economy. The global market for telecommunications, software, and electronics is expected by some to reach $3 trillion by 2010.
>
> Telecommunications is one of the fastest growing industries in the United States. In 1994, the North American Telecommunications Association (NATA) projected that the telecommunications equipment market, with sales of $52.5 billion in 1992, was growing more than 14.9 percent a year and would reach $103.8 billion in 1997.[24] According to a 1999 study conducted by Craig L. Moore, professor in the Isenberg School of Management at the University of Massachusetts Amherst, the information technology (IT) sector of the economy is growing at a much faster rate than is the national economy as a whole.[25]

Lynn, Massachusetts, has historically been an industrial city. For most of the past century, General Electric has been its major employer. In the past two decades, however, GE has sharply decreased its operations in Lynn. Though this has contributed to the city's economic decline, Lynn does have an infrastructure that bodes well for telecommunications development. The primary goal of this study is to show how this economically depressed city may take full advantage of its available telecommunications infrastructure as a tool to promote economic development.

Community Overview

Economic History

The city of Lynn is located 11 miles north of Boston on the north shore of Massachusetts Bay. Lynn was settled in 1629, originally bearing the name "Saugust." Leather and tanning were its first major industries, and by the mid-

[24] COBA –M.I.D, *Massachusetts Communications Technology Park Feasibility Study* (1994).
[25] Moore, *Information Technology: The New Foundation, University of Massachusetts Donahue Institute* (1999).

1700s women's shoemaking had begun to bring prosperity to the city. A trolley line, opened between Boston and Salem in 1837, encouraged growth of Lynn's shoe industry. A factory district took hold, surrounded by neighborhoods of boardinghouses to lodge the workers. Lynn developed into a "shoe town," eventually becoming the world's largest producer of women's shoes.

In 1892, the Edison Company and Thomson-Houston, the nation's largest electrical companies, merged to create the General Electric Company. GE was one of the first U.S. industries to realize the need for on-the-job training to guarantee an adequate supply of skilled workers. The Apprentice School, formed in 1902, graduated thousands.

During World War II, GE grew rapidly in response to orders for armaments; the Lynn plant produced the first jet engine built in the United States in 1942. For the next three decades the company, and the city, depended heavily on military contracts. In the 1980s, however, GE began downsizing its operations in Lynn and moving them overseas, a trend that continued through the nineties. This decline in the city's manufacturing base has taken a heavy toll on the city's economy. Today, like many industrial cities and towns in New England, Lynn is struggling to recapture the strong economy it enjoyed in the industrial age.[26]

Lagging on the Socio-Economic Scale

According to 1990 Census statistics, Lynn falls below both state and national averages for median household income: $28,553 for the city, in contrast to the state median of $36,952 and the national median of $30,056. Nearly 45 percent of the city's families had incomes below $25,000 (see Figure 1).

[26] Historical information from *Lynn: One Hundred Years a City* (1950).

Figure 1

Income Distribution in Lynn, 1990 (Median Household Income: $28,553)		
	Number of Households	Percent of Total
Less than $5,000	2,102	6.7
$5,000 - $9,999	4,435	14.1
$10,000 - $24,999	7,476	23.7
$25,000 - $34,999	4,444	14.1
$35,000 - $49,999	5,687	18
$50,000 - $74,999	5,133	16.3
$75-000 - $99,999	1,562	5
$100,000 or more	551	1.7

Source: 1990 US Census

Educational Attainment

Once again, education is an important requisite for taking advantage of a new opportunity, this time the telecommunications infrastructure in Lynn. The percentage of Lynn residents with college or advanced degrees is lower than the national average and lower still than in Massachusetts as a whole.

Figure 2

Educational Attainment in Lynn, by Percent of Population 25 and Older

	Less than High School	High School Degree	Some College or Two-Year Degree	Bachelor's Degree	Professional or Graduate Degree

	25%	**30%**	**25%**	**13%**	**7%**
	20%	**30%**	**23%**	**17%**	**11%**
	27%	**36%**	**23%**	**10%**	**4%**

Unemployment Rate

The unemployment level, an indicator of economic distress, remains high in Lynn: 4.1 percent in 1999, compared to 3.2 percent in Massachusetts. There was a similar disparity throughout the past decade: the gap between the city and the state unemployment rates was wider at the end of the 1990s than at the beginning.

Figure 3 - Unemployment Rates, Lynn and Massachusetts

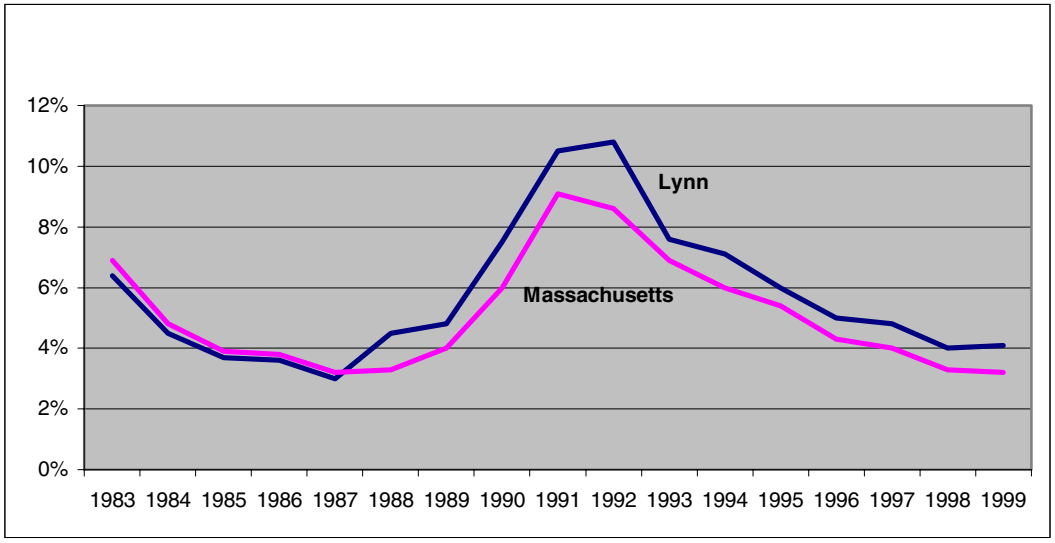
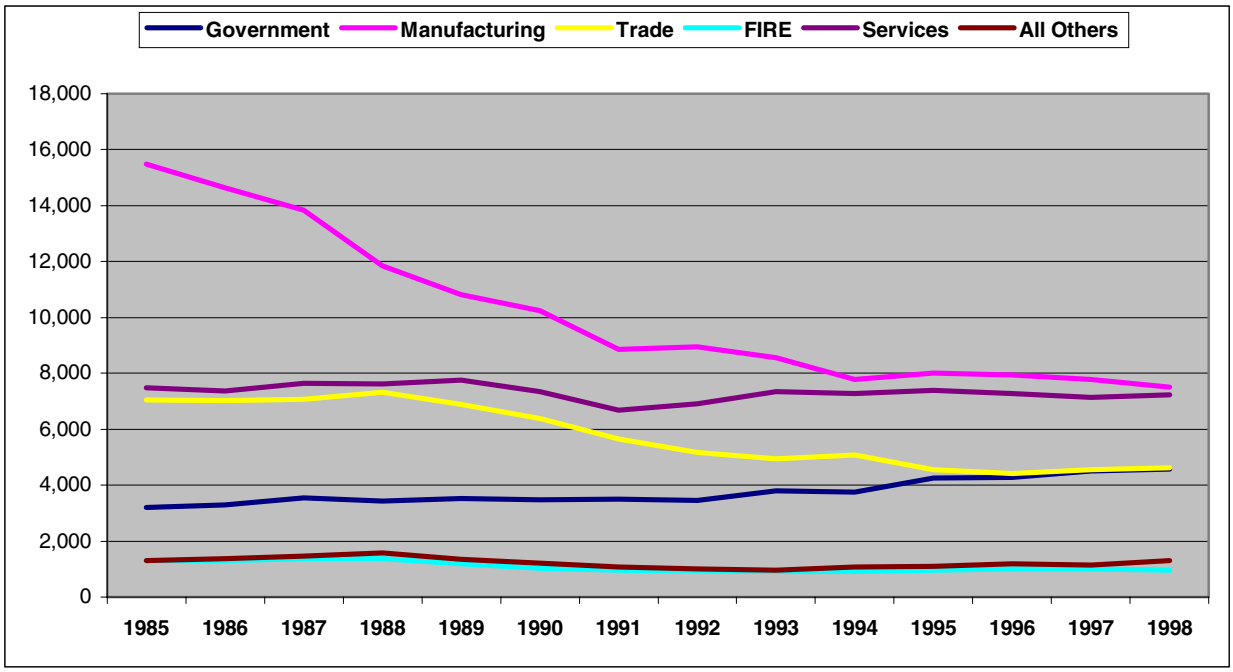


Figure 4 - Lynn, Massachusetts, Employment by Sector, 1985 - 1998



Source: Commonwealth of Massachusetts, Division of Employment and Training (ES-202 Series)
Note: Due to changes in industry definitions, data prior to 1988 are not strictly comparable to more recent data.

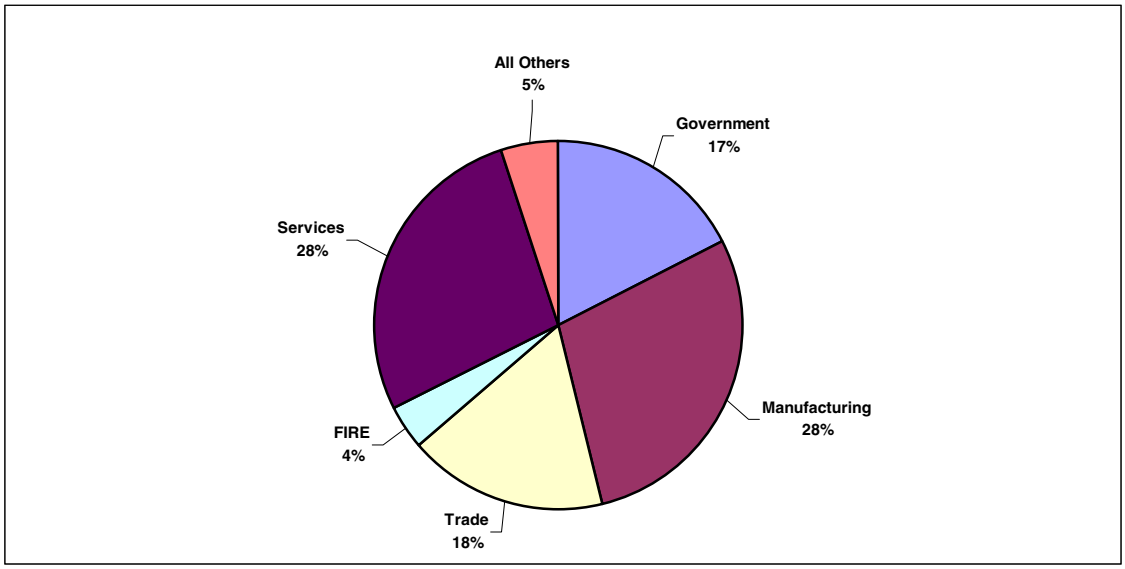
Economic Base

Major Divisions of Employment

The downsizing of General Electric during the 1980s and 1990s affected the distribution of the labor force. The number of employees in manufacturing has decreased by nearly 75 percent since 1985. Upon comparison with the economic base in the state as a whole, however, manufacturing still holds a strong position in Lynn, at 28 percent. Thus, the shift from manufacturing to services is not occurring as it is in the overall state or the nation. The Commonwealth's prosperity in the 1990s was driven largely by service-sector growth, while Lynn has experienced a slight decline in service employment since 1985. As manufacturing declined in recent years, the percent of service-sector jobs has increased, without a real addition to employment in the sector.

In the same period, constant growth has been observed in the small government sector, which has nearly doubled. However, though GE is no longer expanding and its presence has recently been diminishing in Lynn, it still is the city's number-one employer, accounting for 24.5 percent of the employment in 1999.[27]

Figure 5 - 1998 Employment in Lynn by Major Divisions



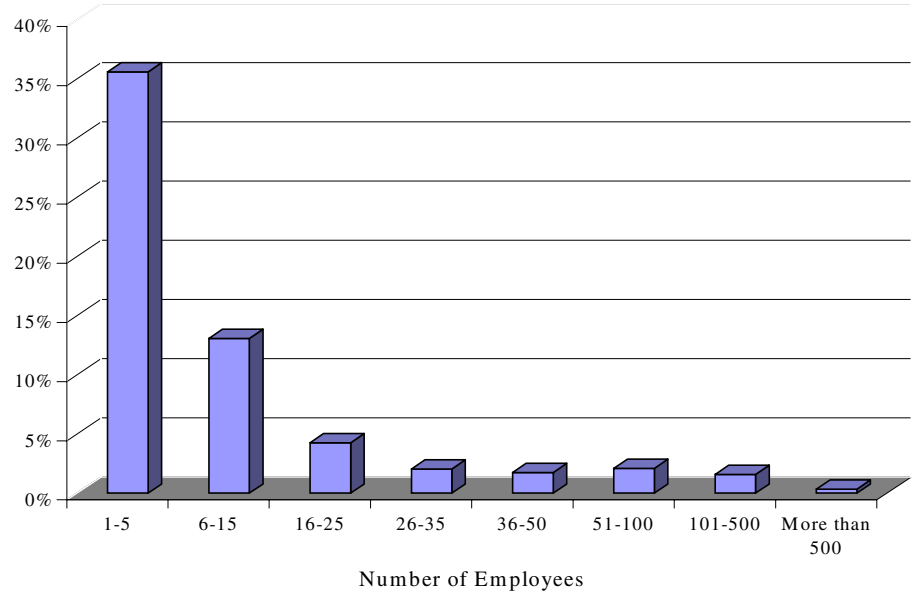
Source: Commonwealth of Massachusetts, Division of Employment and Training (ES-202 Series)
Note: Due to changes in industry definitions, data prior to 1988 are not strictly comparable to more recent data.

Establishment Size

Businesses with fewer than six employees make up the largest part of Lynn's business sector. (By the USA Small Businesses Association definition of small business for most industries: up to 500 employees, 99.69 percent of firms in Lynn are considered small businesses.) These have the potential to be prime players in the economic revitalization of Lynn.

[27] iMarket Inc., MarketPlace Business Data, 2000

Figure 6 - Distribution of Businesses by Number of Employees



Source: iMarket, 2000

Community Context

History of Technological Penetration into the Community Economy

It is generally recognized that four elements are required for successful utilization of telecommunications in economic development:

1. *Infrastructure—the phone lines, satellites, and associated equipment that allow telecommunications to work;*
2. *Access—a way for the end user to utilize the infrastructure at a reasonable cost;*
3. *Applications—uses for the telecommunications equipment; and*
4. *Training and support—to assure that it all works smoothly.*[28]

Lynn has all four of these elements. The city is heavily urbanized and is home to a main Verizon (formerly Bell Atlantic) telephone switching center; Shore.net, a local full-service Internet Service Provider (ISP) that maintains data storage

[28] From Dr. Edwin B. Parker's keynote address on rural telecommunications development, May 14, 1999. http://www.sobusi.com/scot/notes/99_05_14_parker.html.

facilities in the Greater Boston area; and Beckles Enterprises, Inc., a Web site design firm. All areas of the city have access to telecommunications services, such as full-service, high-speed broadband Internet, cable, and up-to-date telephone and premium services.

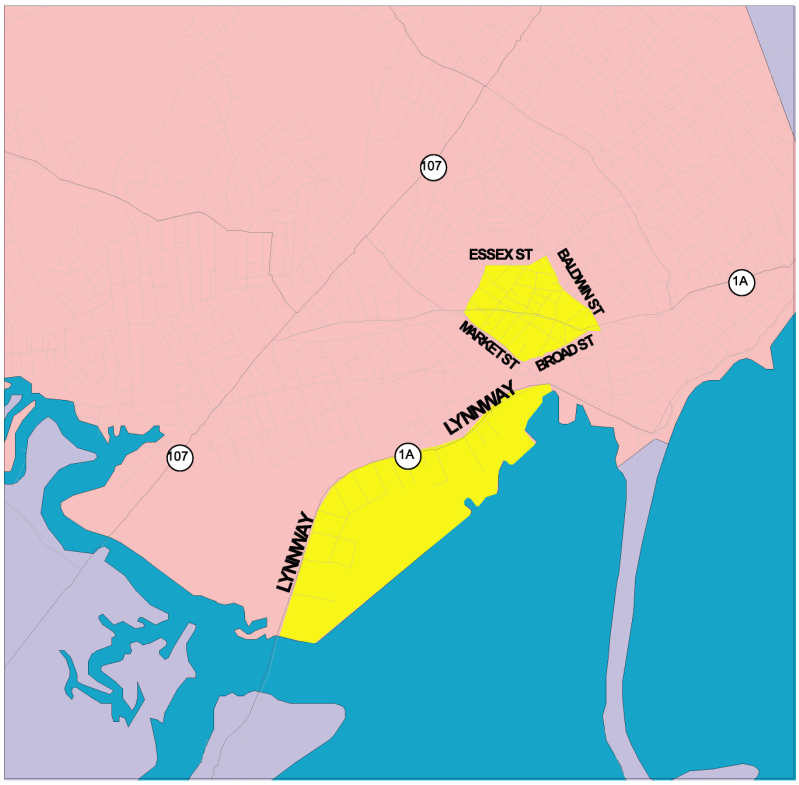
There are plans to lay national and international high-speed cables directly through Lynn, and linking with Boston. Lynn already has more than adequate high-speed access, and improvements over the next couple of years will rank it among the best anywhere. The challenge for Lynn is to take advantage of this opportunity on its own behalf and not to become merely a landing ground for high-speed access to Boston.

Level of Technology

The city is quickly becoming known as a telecommunications hub for New England, because of recent private-sector developments along with public/private sector collaborations related to telecommunications. These recent events are described in the following sections of the report.

Cyber District

The Lynn Cyber District was created to capitalize on Lynn's advantages as a location where Internet-related businesses can locate and grow. Almost every building in downtown Lynn is within 1,000 feet of Verizon's central switching office. A web of fiber-optic cable running between Boston and northeastern Massachusetts, New Hampshire, and Maine comes together at that office. This means Internet companies based in Lynn can get unusually good access to global networks and—because Verizon charges by the mile for its high-volume data connections to long-distance carriers—at a low price. In addition to this advantage, Lynn offers low commercial rents, about half the price of comparable properties in other cities.



Lynn Cyber District

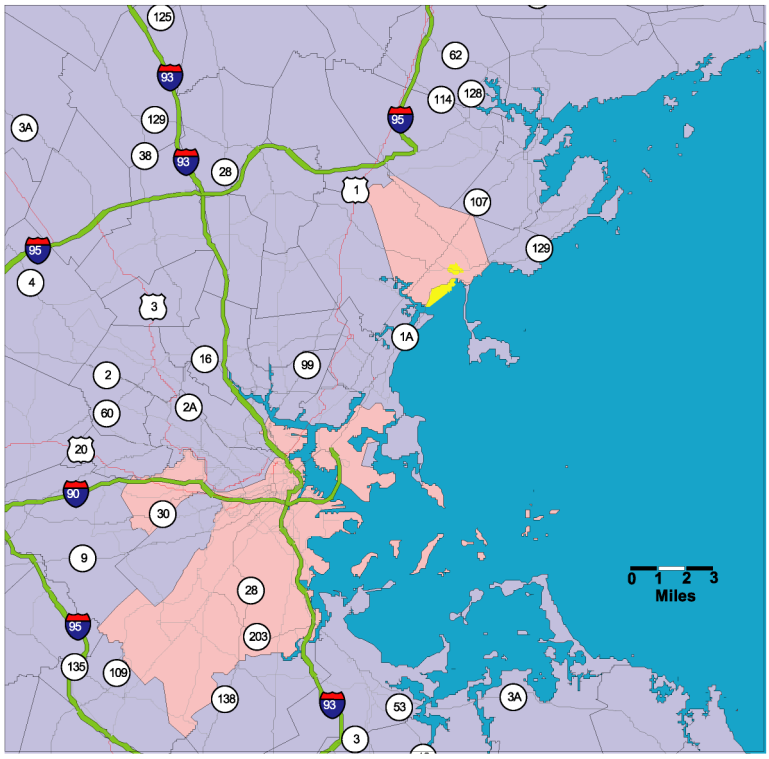
This gives Lynn a niche that was desperately needed. Already, a half-dozen small Internet-related businesses have located in this downtown Cyber District.[29]

The Lynn Cyber District Council (LCDC) has given the city a focal point for economic development efforts. Its purpose is to identify issues and opportunities for Cyber District businesses, to develop a plan that will recruit and grow Internet-related businesses and increase an overall businesses presence, to create a number of high-skill and high-wage jobs in technology-based industries, and to alleviate blight in downtown Lynn.

National and International Telecommunications Infrastructure

[29] Ackerman, Jerry. "Firms find Lynn well-connected to the future." Boston Globe (October 25, 1998): p. G1.

In the past year, negotiations between the city and Worldwide Telecom have resulted in the decision to make Lynn the hub of New England's first intercontinental fiber-optic cable, capable of handling 12 million high-speed transmissions simultaneously. Transatlantic communications for Boston and the New England region have previously been routed through New York. Lynn was chosen because of its proximity to Boston, Worldwide Telecom's primary target area, and because of the city's inactive port, thus turning a seemingly negative aspect into an asset. The facility operating the cable system will employ approximately 15 people.



Lynn, MA in Relation to Boston, MA

This move will also help to enhance competition for bulk telecommunication access for area ISPs and other telecommunications service providers by giving companies an alternative to purchasing bulk access from Verizon, currently the main telecommunications carrier.[30]

[30] "Fiber-optic Cables: A New Lynn Export" (1999).

The construction of the transatlantic cable has prompted other companies in Lynn to consider developing telecommunications infrastructure enhancements. One such company, Assets Channel, Inc., is currently in negotiations with the city to connect an eastern seaboard fiber-optic cable to the transatlantic cable. This cable would stretch from Lynn to Miami, Florida, with multiple main connections along the Atlantic coastline.[31] Such an infrastructure development could prove very beneficial, not just to Lynn but to Boston and New England as a whole, by increasing the region's share in the worldwide telecommunications network.

Local Internet Service Providers

With 30,000 subscribers in the region and approximately 80 employees, the local ISP Shore.net was recently acquired by PRIMUS Telecommunications Group. PRIMUS is a global-facilities-based total serve provider (TSP) offering e-commerce, Internet access, and data and voice services on a bundled basis.

Shore.net was attractive to PRIMUS for its success in the following areas: it provides broadband connectivity services to more than 30,000 small and medium-size enterprises and a limited number of residential customers in New England; it has its own high-capacity network that extends through Massachusetts and New Hampshire with more than 100 POPs and extensive private peering with leading tier-1 carriers and ISPs; and it has the capability of offering clients advanced Web-hosting services on both Unix and NT platforms.[32] Acquiring Shore.net will allow PRIMUS to initiate the expansion of its services nationally, targeting SMEs and high-growth "dot-com" companies.

Though strictly a private venture, this acquisition could have a potentially large and vital economic impact on Lynn and the surrounding communities. PRIMUS has already announced plans to construct a call center in Lynn, which will provide additional telecommunication services to local businesses and increase

[31] Interview with Lynn city officials Peter Deveau, Hal McGaughey, and Stephen Harausz, and Lowell Gray of Shore.net, March 10, 1999.
[32] From an on-line press release at http://www.shore.net/services/news/aboutshore/ primus/primus.html.

employment in the local area. In addition, the presence of such a large telecommunications firm could generate a snowball effect, encouraging other large companies to come into the city. Furthermore, development of an even stronger telecommunications infrastructure in Lynn has the far-reaching potential to increase the geographic radius of the telecommunications cluster now located along and within the Route128/95 beltway.

Community Vision for IT and Economic Development

Additional citywide economic development efforts further complement the private-sector activity discussed above.

Downtown Revitalization

In an effort to increase the economic benefits offered by recent developments in information technology, Lynn's city government, through its Office of Economic and Community Development, has implemented the Goldblock Project. Its purpose is to revitalize two central city blocks and provide a warmer, more hospitable milieu in this high-traffic area. Several construction activities are planned for the area, including building renovations, tree plantings, the installation of "antique" lighting, and the construction of brick sidewalks and granite crosswalks.[33] HUD money and private investments have provided funds for this project. Projects such as this will help the city create a pleasant urban environment to attract high-tech businesses to its downtown area.

Another interesting trend, also of substantial importance for revitalizing Lynn's economy, is the appearance of "bohemian fringe" businesses related to the arts. This has proven to be important for attracting another entrepreneurial and more-established businesses, such as lawyers, consulting services, retail, etc.[34] There

[33] *Daily Evening News,* March 6, 2000
[34] See Godfrey, *Neighborhoods in Transition* (1988); Forsyth, "NoHo" (1997).

are currently 78 art-related businesses in Lynn, accounting for 4 percent of total employment.

> **In 1994 the city established a downtown Arts and Cultural District. It is headquartered at LynnArts, a private, non-profit organization dedicated to promoting cultural activity. It provides services to various arts and cultural groups, individual artists, and the community at large. Many artists have already relocated their studios to downtown Lynn. A flourishing cultural life can encourage activity on evenings and weekends, attracting tourists and additional creative businesses to the city.**
>
> **The Arts District is an outgrowth of the Empowerment Zone Strategic Plan, part of an application process for designation as an Enterprise Community. Though the application was not approved, the city benefited from the process, which involved hundreds of residents and business owners in developing a shared vision.**

Many of Lynn's emerging industries rely heavily on information technology. Medical services, the second largest sector in the city's economy, is an obvious example of activities in which communications networks are vital. As computer networking becomes increasingly important to economic revitalization, there arises a "digital divide" between old businesses that fail to adapt to the new technology and new businesses that thrive on it. Strong local government policies and citizens' initiatives are needed to ensure that technology does not widen this gap and leave old businesses behind. It will be useful for the Chamber of Commerce to develop a set of indicators to measure the level of telecommunication utilization by small businesses and, based on these indicators, to assess the depth of the digital divide in Lynn.

Local Public Policy

The City of Lynn has developed a comprehensive set of programs to provide start-up and other small businesses with technical and financial assistance. Though these programs are not aimed solely at telecommunications-dependent

companies, a greater emphasis has been placed on attracting companies that are heavily dependent on telecommunications services. A number of agencies in Lynn, all operating under the umbrella of the city's Office of Economic and Community Development, provide various types of assistance to start-up and small businesses.[35]

The Lynn Department of Community Development is responsible for obtaining and administering federal and state funds for a wide array of development initiatives, community facility projects, and public-sector activities. These activities include design, construction, and oversight of public infrastructure improvements; rehabilitation of older buildings in the city; and renovation of recreational areas.[36]

The Economic Development and Industrial Corporation (EDIC/Lynn) is a non-profit organization established under a state mandate in 1977. Through innovative programs, this corporation puts financing tools into the marketplace, making capital available at attractive rates. EDIC/Lynn provides help in obtaining funds through the following economic-development programs to prospective developers and businesses: the Micro-Loan Fund, the EDIC/LMFC Loan Fund, the EDIC-EDA Revolving Loan Fund, the Macro Loan and Job Creation Program, and the Commonwealth of Massachusetts Economic Development Incentive Program.

In conjunction with the Massachusetts Office of Business Development, EDIC/Lynn has implemented a series of aggressive initiatives geared at job creation, attracting new businesses and allowing firms to expand. One such initiative is the Tax Incremental Financing (TIF) Plan, under which the City of Lynn and a prospective developer agree to a property exemption, over as many as 20 years, based on the value added to a property through construction, rehabilitation, and renovation. Such projects, which require certification by the

[35] See http://www.lynndevelopment.com.
[36] See http://www.lynndevelopment.com.

State Economic Assistance Coordinating Council and the Lynn City Council, have received strong support from both developers and elected officials and have been essential to the economic resurgence in the city.

The Lynn Small Business Assistance Center (LSBAC) provides enterprise development services and technical assistance to new and existing businesses. The Center offers a vast array of services, from management training to bookkeeping assistance to Web site development. It maintains a reference library that provides high-speed access to the Internet and is equipped with state-of-the-art business-development software. In addition, LSBAC, in conjunction with the EDIC/Lynn, provides a business site search service, which helps clients planning to establish or relocate a business to find appropriate office, retail, warehousing, or manufacturing sites in Lynn.

The Lynn Business Advocate, working out of the city's Planning Department, acts as a liaison for the city toward prospective start-up businesses. The Business Advocate is available to guide a prospective business though the city's permit-approval process and, if necessary, accompany the new business owners to each city department or agency and brief the department heads on the company's proposal.

The Lynn Cyber District Council (LCDC) is developing Lynn's downtown into a Cyber District where Internet-related businesses can locate and grow. The LCDC works with established and new businesses to organize needed resources, programs, and initiatives to help foster business development. Its objectives are to increase the number of businesses and jobs in downtown Lynn, especially high-skill, high-wage jobs in technology-based industries, and to alleviate the blight in the downtown area by making it a more attractive business center.

Lessons and Recommendations

Lynn has undertaken several initiatives to utilize telecommunications in its economic development. Some of these are consistent with "best practices" implemented in other communities (see Appendix 3). However, a review of the existing climate of the city has revealed a few weak areas. These weaknesses are not overwhelming and could be remedied without a major allocation of resources.

Community Strengths

Business-oriented city agencies. The Lynn city government has pursued the establishment of businesses within the community through creation and nurturing of development partners, such as the Cyber District Council, the Economic Development and Industrial Corporation, the Small Business Assistance Center, the Chamber of Commerce, the Latino Business Association, and the Lynn Business Advocate. This can help to expand communications with the business community and establish the trust between businesses and government necessary to improve existing conditions and promote creative solutions.

North Shore Community College. In response to the anticipated need for a more qualified labor force, the local community college has established an associate's degree program in telecommunications and a 600-hour certification program called Fiber Optics/Cabling Technology. Companies throughout the North Shore participate in curriculum development and offer students field experience. Furthermore, the college offers programs in MSCE and A+, Oracle, Web design, and e-commerce. The college would like to develop another corporate training center in the Lynn area similar to one it recently opened in Beverly, to expand its training options.

Streamlined permitting processes. The city, through its Economic and Community Development director, has streamlined a few of the procedures involved in establishing a business in the city. This encourages business

development and growth in this community, showing potential businesses that the city is business-friendly.

Implementation of development proposals. Lynn does not have a formal economic-development plan to guide actions or activities (see Recommendations, below), but city officials have turned this weakness into a potential strength by implementing beneficial economic-development proposals gleaned from its Cyber District Contest and offered by business leaders. This allows the city flexibility in the way it views economic development and promotes the use of telecommunications in a rapidly changing economic and technological business environment.

Integration of other city programs into economic-development initiatives. The city has utilized its community-development resources to help improve economic conditions for its residents. These include the rehabilitation and improvement of city blocks and urban infrastructure. Such activities improve the built environment for both residents and local businesses. In addition, the projects funded through this integration of programs combine to enhance its quality of life, strengthen its identity, and cultivate a positive perception of the city as a whole.

Use of the Internet. Since January 2000, Lynn has developed a series of integrated Web pages to promote the city, showing prospective businesses and potential residents what it has to offer. The site provides useful links to various local, state, and federal business-development sites. The information on these Web pages is comprehensive and is continuously updated. This initiative allows the city to market itself to the worldwide Internet audience, and shows prospective developers and businesses the extent of telecommunications available in the area. Additional sites and services currently under construction include a property locator, with which developers will be able to conduct an on-line reconnaissance survey, matching their specific requirements with available properties in the city. Another site will list all the businesses currently located in

the city by category type. This will foster the development of business clusters and could encourage the growth of certain types of businesses in the city. By deciding which category types it will place on the site, the city can promote certain desirable sectors while placing less emphasis on others.

Positive city/business relations. The city government is developing positive relationships with the local business community and business leaders. Such an open and honest civic atmosphere is crucial to the development of a healthy local economy and to the promotion of economic development. When the business community is confident that the city is willing to discuss matters in a professional and meaningful way, it is far more likely to advance more resources and invest in the community.

Community Weaknesses

Lack of an effective transportation network. Lynn currently lacks an adequate highway network within and around it, thus making travel to and from the city somewhat cumbersome. This is especially problematic during the morning and afternoon rush hours. This situation is presently out of the control of city officials, since a great deal of state and federal funding would be needed to alleviate the problem. With Boston's "Big Dig" project currently taking the lion's share of the state's highway budget, improvement in Lynn's transportation situation does not appear plausible in the near future. A commuter rail line provides residents with good public transit to and from Boston, but this train has a limited schedule. Lynn also has a stop on the MBTA's Blue Line, which runs into Boston via Logan Airport. Although the stop is not in the center of Lynn (it is on the border of Lynn and Chelsea), it is a benefit that the city could better promote.

Lack of a skilled work force. There is currently a gap (whose extent is undetermined) between the skills of Lynn's work force and those required by telecommunications businesses. The city has not implemented a skills-development course for residents, either through community-development grants

or general funding. If the available work force continues to lack the required skills, the city may have a problem in attracting IT-based businesses. Development of an educational initiative between the city and the local community college would help Lynn attain the necessary skilled work force while enhancing and promoting economic development for both businesses and city residents.

Lack of a variable-time downtown economy. The plans put forward by city officials for the revitalization of the city's downtown do not appear to envision a variable time frame. The emphasis at the moment is on the 9-to-5 downtown economy. In a city the size of Lynn, this is not an efficient use of the central business district. Aside from making downtown less attractive to prospective businesses, such an emphasis creates a "ghost downtown" after 5:00 P.M., possibly placing more stress on police, fire, ambulance, and other emergency services.

Lack of job creation in current IT infrastructure projects. Though Lynn is becoming a communications hub for Boston and New England, this is not sufficient. The number of workers estimated to be required by the fiber-optic installations is minimal—15 for Worldwide Telecom, including existing employees—and Shore.net's total employee count will not increase immediately, in the wake of its acquisition by PRIMUS. Even the proposed introduction of a PRIMUS call center into the city may create only a few hundred jobs, compared with the several thousand jobs lost in the General Electric downsizing. If these telecommunications projects are to dramatically increase employment, secondary and tertiary job creation will have to result from the improved infrastructure. The city does not appear to be focusing directly on this issue.

The digital divide. As computer networking becomes increasingly important to economic and social success, too many businesses are failing to acquire the new technology as rapidly as their more affluent neighbors. This gap between

businesses, individuals, and communities that have access to advanced telecommunications technology and those that do not will have to be rectified if Lynn is to fully enjoy the benefits of the technological revolution.

Recommendations for Improvement

1. Create an economic-development plan. An economic-development plan would help the city assess its strengths and opportunities as well as some of its weaknesses, effectively gauge the business climate and the needs of the existing community, provide recommendations for increasing economic development, formalize policies and initiatives for the business community, and provide for future strategic planning and continuity of implemented actions by subsequent city officials.

2. Continue the working relations established with the business community. As a fundamental step in increased economic development, a healthy and committed government/business relationship is important in attaining creative and credible solutions to existing or potential problems foreseen by both parties.

3. Develop economic indicators and evaluation procedures. A set of indicators (measurements or benchmarks) will help the city measure growth in economic activity attributed to the promotion of a telecommunications infrastructure. (A list of indicators is provided in Appendix 4.) The development of specific indicators and an evaluation plan will establish the criteria by which success will be measured and assessed. Formal evaluation of activities will also provide valuable—and often required—information for future federal and state project funding.

4. Implement visioning sessions with the business community. These sessions, aimed at increasing public participation and establishing a realistic vision for the city's economic future, should embrace the whole of the business

community. It is important that they include an implementation plan to achieve the vision set forth by the planning process. Vision without action will actually diminish the city's economic-development credibility.

5. Develop an educational collaboration with the community college. Such a collaboration would benefit the city overall, as it would work toward increasing the economic empowerment of the local residents while attaining the skilled work force necessary for the city to attract higher-wage jobs. This activity could possibly be financed through community-development funds and placed into a five-year consolidated plan.

6. Take a self-assessment test. This economic-development tool asks officials to evaluate the city's current status in such areas as vision and leadership, planning and implementation, infrastructure, policy, education, and development strategy. The process would help city officials focus and clarify their economic-development plans, establish a timeline from which benchmarks could be developed and implemented, and put current activities into a longer-term perspective.

7. Review the existing zoning map and ordinances. To avoid potential conflicts between economic-development initiatives and zoning requirements, the city should review the current zoning on all properties located within proposed economic development or revitalization areas. This review would also establish a picture of where future initiatives could be placed and to what extent current activities might help certain neighborhoods.

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http://www.census.gov (for county business patterns)

http://www.detma.org (for employment information)

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http://www.digitaldividenetwork.org/frameset.adp?url=http%3a%2f%2fwww%2ebenton%2eorg%2fDigitalBeat%2fdb070899%2ehtml (The Digital Beat)

http://www.digitaldividenetwork.org/frameset.adp?url=http%3a%2f%2fwww%2ebenton%2eorg%2fDigitalBeat%2fdb111299%2ehtml (Resolving the Digital Divide)

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Case Study:
New Bedford

Contents

Case Study: New Bedford

Overview

Historically, New Bedford has had an economy centered on its fishing industry. The whaling capital of the world in the 18th and early 19th centuries, the city evolved to become the home of textile and other manufacturing industries in the 19th and 20th centuries. The city's port has long been one of the busiest in Massachusetts and remains an active contributor to its economy. However, New Bedford, like other cities in the southeastern part of the state, was hit hard by twentieth-century declines in manufacturing and the fishing industry. Its economic struggles continue to this day.

Between 1985 and 1996, New Bedford lost 25 percent of its employment base. Fishing and manufacturing decreased by 53 percent and 52 percent, respectively. The city lost 2 percent of its population between 1960 and 1990, while the rest of the region grew at 80.9 percent. Building permits in New Bedford and the five other cities in the region comprised only 17.1 percent of the region's total between 1980 and 1994. Land-use patterns, unemployment rates, and incomes point to continuing structural problems in the regional economy.37 Perhaps of most concern, the area is limited by a workforce with below-average educational attainment. There is a 40 percent high school dropout rate, and in the 199o only 47 percent of the labor force between the ages of 18 and 64 had high school diplomas.

Economic Base

Labor Force and Unemployment

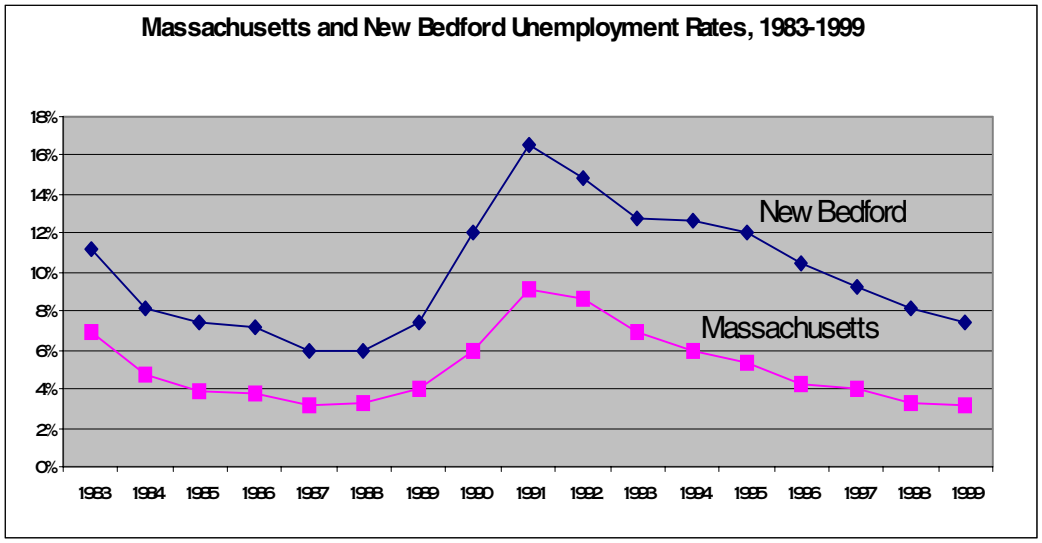
In 1999, the labor force in New Bedford stood at about 41,000. This represents a drop of 20 percent, from 51,300 in 1983. During the same period, the overall employment level dropped by 17 percent. Since the peak of the recession in 1991, employment has remained steady, while the labor force has declined by about 4,000 employees. The

[37] Clyde Barrow, "Southeastern Massachusetts: A Region of Growth without Development," *Massachusetts Benchmarks* 1 no. 3 (Summer 1998).

implication of this is that any reduction in unemployment is due, at least in part, to the reduction in the labor force rather than the creation of jobs. People are leaving the city for jobs elsewhere.

Every year since 1983, New Bedford has had a higher unemployment rate than Massachusetts as a whole, by an average of 5 percentage points. This peaked during the recession in 1991, with a 7.4 percent difference, and has narrowed since. Despite the varying margins, the state and local unemployment trends move in similar patterns. Even during the current boom, when the rest of the state and country have been struggling to find workers, New Bedford has suffered from high unemployment figures. In 1999, as the Massachusetts unemployment rate fell to 3.2 percent, New Bedford had 7.4 percent unemployment, a rate close to the state's recession level.

Figure 1

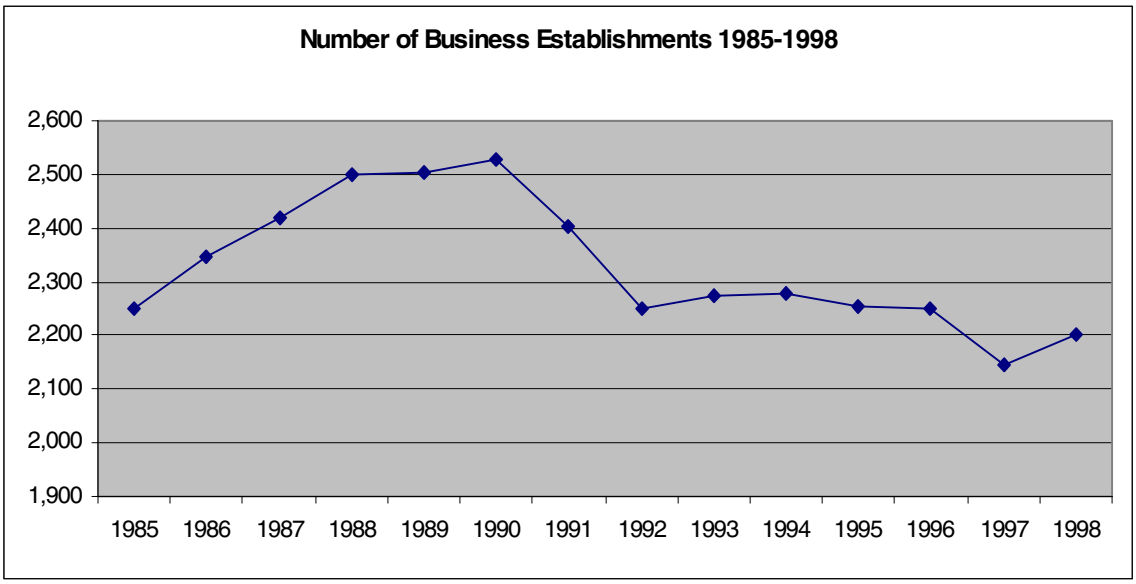


Number of Business Establishments

As seen in Figure 2, in 1998 New Bedford had 2,220 business establishments. This compares with a pre-recession peak of 2,526 in 1990. This reduction may indicate that employers are moving out of New Bedford or that there is some consolidation of local

businesses. It might imply that some establishments are gaining market share and putting others out of business. In other words, there may be fewer business establishments, but that does not necessarily mean less demand or expenditure by consumers.

Figure 2



Major Divisions of Employment

From 1985, when New Bedford boasted 20,582 manufacturing jobs, to 1998, 11,170 such jobs were lost in the city. This represents a drop of more than 50 percent. In the same period, the agriculture, forestry, and fishing sectors lost 920 jobs, a drop of 58 percent. The only sectors in which employment increased were services, which gained 22 percent, and government, which grew by 6 percent. Most of the increase in the service sector was in the early nineties, not in recent years. By contrast, in these same years Massachusetts has moved dramatically toward a service-based economy. The FIRE (finance, insurance, and real estate) sector also has a larger employment base statewide than in New Bedford: 7 percent in the state as opposed to only 4 percent in the city. (See Figure 3)

Figure 3

Manufacturing Base

A comparison of the top five manufacturing sectors in New Bedford and the state shows that three of these appear in both lists. Yet the top New Bedford manufacturing sector, an Apparel–Finished Products category, which accounts for 22 percent of the city's manufacturing jobs, is only the thirteenth-highest manufacturing employer in the state.

Top 5 Manufacturing Sectors, New Bedford and Massachusetts

New Bedford

SIC	Sector	Employees	Percent of Total Manufacturing
23	Apparel, Finished Products from Fabrics & Similar Materials	2,241	22.0
36	Electronic, Electrical Equipment & Components, Except Computer Equipment	1,470	14.4
30	Rubber and Miscellaneous Plastic Products	1039	10.2
38	Measure/ Analyze / Control Instruments; Photo/ Medical; Optical Goods; Watches /Clocks	970	9.5
20	Food and Kindred Products	915	9.0
	Total Manufacturing	10,208	

Massachusetts

SIC	Sector	Employees	Percent of Total Manufacturing
38	Measure/ Analyze / Control Instruments; Photo/ Medical; Optical Goods; Watches /Clocks	68,094	14.3
35	Industrial and Commercial Machinery and Computer Equipment	66,867	14.0
36	Electronic, Electrical Equipment & Components, Except Computer Equipment	64,429	13.5
27	Printing, Publishing and Allied Industries	55,269	11.6
20	Food and Kindred Products	30,310	6.4
	Total Manufacturing	476,168	

Services Base

Services now make up 33 percent of the New Bedford economy, according to data from the second quarter of 2000. This is low, compared to the service sector's 41 percent share of the Massachusetts economy. In addition, the city rarely compares to the state in the relative representation of the various sectors of service-related employment. While health-service jobs make up 41 percent of this sector in New Bedford, they account for only 22 percent of the state's service employment. Similarly, social services account for 11 percent of service-sector employment in New Bedford, compared to 6 percent statewide.

The situation is reversed in educational services (10 percent in New Bedford and 16 percent statewide), business services (5 percent and 17 percent, respectively), and engineering, accounting, research, management, and related services (6 percent in New Bedford and 15 percent in Massachusetts).

Figure 4

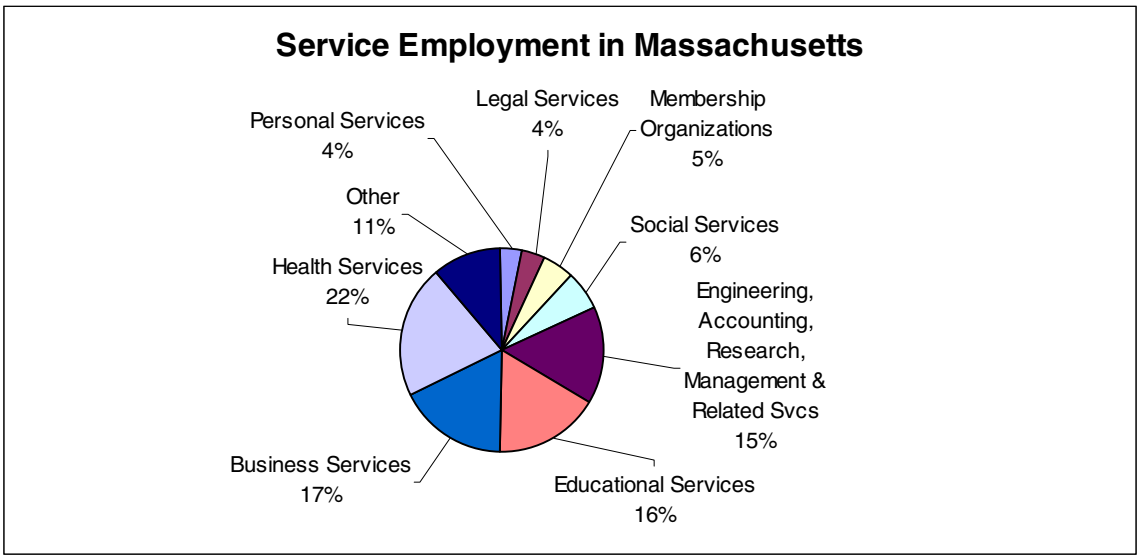
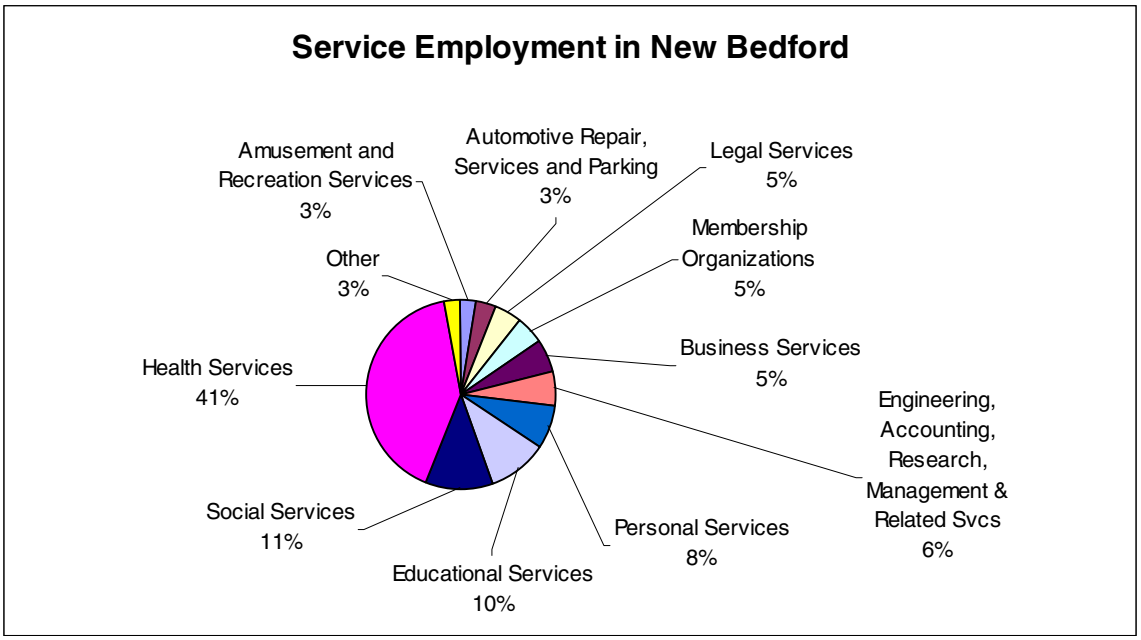


Figure 5



Source: iMarket

New Bedford in a Regional Context

The Southeast region of Massachusetts is made up of three economically diverse sub-regions: Tri-Cities, South Shore, and South Coast. It consists of 48 cities and towns in Bristol, Plymouth, and Norfolk counties. The region, occupying 1,224 square miles, had a population 993,800 in 1998, reflecting an increase of more than 44,000 (4.5 percent) since 1990. The major cities of Attleboro, Brockton, Fall River, New Bedford, and Taunton account for 37.5 percent of its population.[38]

The South Coast sub-region consists of 14 cities and towns with a total population of roughly 340,000. Roughly 55 percent live in New Bedford and Fall River. Despite business and housing costs that are lower than those in Boston, the South Coast has been less able to capitalize on the state's general prosperity than Tri-Cities and South Shore areas. Different economic bases, commuting patterns, and transportation arteries, along with demographic profiles, affect economic development in each of the sub-regions.

The South Coast consists of three significant business clusters—manufacturing, distribution, and services—all of which have traditionally shared in the maritime history of the region's small towns. The average annual individual earnings in these industries have risen at about the same rate as earnings throughout the state, from $25,886 in 1997 to $27,948 in 1999.[39] This is an increase of 7 percent, consistent with the 8 percent increase statewide. However, the South Coast region's average salary remained 27 percent lower than the state mean of $38,284 in 1999.

Manufacturing has seen little or no net growth in the region in recent years. Textiles and apparel—still an active market despite off-shore apparel production—currently anchor manufacturing employment, which declined from 25.5 percent of total employment in 1997 to 20.1 percent in 1999. On the other hand, an emerging high technology sector grew from 2,911 jobs in 1997 to 4,819 in 1999. Most of the jobs in high technology are in

[38] Clyde W. Barrow, "From Deindustrialization to Divergence," *Massachusetts Benchmarks* 3, no. 2 (Spring 2000):19–22.
[39] Massachusetts Division of Employment and Training.

electronics and medical and marine instrumentation.[40] Despite the overall decline in manufacturing, this sector still provides some of the best-paying job opportunities.

Lower costs and labor availability make the South Coast area a profitable site for warehousing and distribution. This sector grew by 28 percent in two years, from 6,016 jobs in 1997 to 7,692 in 1999, with average annual wages of $30,867 at the close of the decade. In order to continue this growth, however, the manufacturing seaport that receives the cargo must be upgraded. The harbor is to be dredged to channel cargo ships.[41] Other seaport improvements should include dock maintenance, new equipment, and environmental regulations.

Of the South Coast region's significant business clusters, the service sector has shown the most growth in the last decade, led by allied health services and business services. Region-wide, allied health services grew from 16,383 jobs in 1997 to 16,914 in 1999. However, the region's health-care providers remain dependent on the availability of Medicare and Medicaid reimbursements for services to their elderly and low-income customers. Business services have grown at a faster rate, from 4,779 jobs in 1997 to 5,292 in 1999. Most of this growth, however, has been in support services, which pay lower wages than area and state averages, for an annual average income of $23,723.

Overall, the economic picture in New Bedford is of a city with a high unemployment rate, a shrinking labor force, and stagnant employment and earnings levels in a time of economic boom. This is an economy largely driven by manufacturing companies, but includes a few high-tech firms and significant service and distribution sectors. New Bedford is under serviced and has an under-utilized market potential. This is attributed in part to a lack of intra-regional crossover among the South Coast region's business clusters, which leaves the region with no economic center of gravity.[42] The sub-regions' demographic profiles (e.g., incomes and educational attainment) are both a cause and an

[40] Barrow, "From Deindustrialization to Divergence," 22.
[41] The project, planned for completion in 2006, will involve dredging the equivalent of 25,000 truckloads of dirt from 170 acres of the harbor floor and will lock up PCB-tainted muck in shorefront mounds.
[42] Barrow, "From Deindustrialization to Divergence," p. 22.

effect of this clustering. These factors will not change in New Bedford's foreseeable future without significant changes in the educational attainment of the current labor pool.

Community Vision for IT and Economic Development

New Bedford is not currently a high technology–based economy by any means, nor are current planning strategies aimed at so radically restructuring its manufacturing-based economy.[43] New Bedford is receptive to technological advances that will strengthen its manufacturing industries and which will, in turn, create spin-off markets to foster additional employment opportunities. The city does have the ability to provide a home for Internet-based companies, with the added incentive of a quality of life comparable to Boston's—but considerably less expensive.

Within New Bedford's active seaport is an array of services and infrastructure that will help carry the city through its economic recovery. They include the new closed wastewater treatment facility, the Fort Taber Park renovation and clean up, the Schamonchi ferry service to Martha's Vineyard,[44] the New Bedford Regional Airport, and Greater New Bedford Regional Vocational Technical High School.

The city's quality of life is good. House prices average $100,000–$150,000. One-third of the downtown is a National Historic Park, offering a village-like atmosphere with streets lined with shops and restaurants. This urban park is the seedbed of a new effort on the part of the city to attract tourists and to add a major tourism component to its economic base. Within the Historic Park, cobblestone streets dating back to the time of New Bedford's maritime empire lead to the New Bedford Whaling Museum, currently undergoing a $10 million expansion.

[43] New Bedford's City Planner, David Kennedy, subscribes to the theory that one should work with what is at hand and improve the economic base with those tools already accessible.

[44] In addition to Ferry Schamonchi, Ferry Alert II is available for service to Cuttyhunk from Fisherman's Wharf in downtown New Bedford. Plans are under way to provide access to Ferry Schamonchi from Fisherman's Wharf.

Further testament to the city's range of recreational activities are the public beaches at Clark's Cove, the marina in New Bedford Harbor,[45] and the recently inaugurated Buttonwood Park and Zoo in downtown. High downtown real estate vacancy rates will be eased with the opening of the UMass Dartmouth College of Visual and Performing Arts—a 125,000-square-foot adaptive reuse of an old department store, currently under construction—and the last of New Bedford's remaining 1920s theaters. Other efforts to revitalize downtown include the encouragement of loft apartments and artist studios, the recent opening of a food court and parking garage, and a program to upgrade commercial façades.

The proposed $90 million New Bedford Aquarium complex will house an aquarium, an Explorium, and a large-format film theater, as well as the new Science Education and Economic Development (SEED) Center.[46] SEED, the research arm of the Center for Marine Science Technology, represents the Center's effort to extend its service and expertise. SEED aims to establish New Bedford as the Atlantic Rim center for marine science and education, while making a substantial contribution to the region's economic development. SEED will encompass operational and research facilities, including offices, classrooms, and a conference area; a business incubator industrial park for marine-oriented start-up enterprises; commercial development of emerging technologies; and technical assistance resources for marine-related economic-development agencies.

In the years since World War II, New Bedford has not brokered strong regional relationships. In addition, there has been a historical rivalry between New Bedford and Fall River. It has been suggested that the weakened textile and apparel manufacturing sector can be attributed to the lack of intra-regional communication and cooperation among the South Coast region's business clusters. But New Bedford can no longer afford to isolate itself from its neighbors. Today it is actively working with the South Coast Development Partnership, chambers of commerce, and other bodies to develop regional cooperatives.

[45] The harbor is protected by a hurricane barrier, which is operated by the U.S. Army Corps of Engineers.
[46] The aquarium, on the site of the old COM/Electric power plant, will be developed by Spaulding and Slye and designed by Peter Chemayoff.

A major asset in this effort is New Bedford's relationship with the University of Massachusetts, Dartmouth, five miles from downtown. The University has contributed to the fostering of regional relationships, working over the past two years with the chambers of commerce and mayoral offices of New Bedford and Fall River. While some maintain that UMass Dartmouth—"a university of a region, not in a region"—will be the engine of regional economic development, others insist that to depend on a single institution for economic recovery would simply be to revert to the historical pattern of parochial, introverted economic policy. Fortunately, such a vision is not a part of current economic planning strategies.

The broad vision for economic development in New Bedford encompasses three specific areas of concentration: political partnership, regional infrastructure, and education. The individual initiatives within each area contribute to the broader vision. The political partnership consists of a mayoral initiative to create an alliance between the cities of Fall River and New Bedford, including the active participation of the University and initiatives by private industry to foster public/private partnerships. Planning strategies for regional infrastructure include a proposed MBTA rail connection to Boston, an expansion of the New Bedford Airport (currently delayed), and telecommunications infrastructure, in the form of Internet cable and DSL service, for all of New Bedford.

Education will play a pivotal role in the economic development of New Bedford. Area schools are adequately funded. Greater New Bedford Regional Vocational Technology High School is one of the better vocational programs in the region. UMass Dartmouth is a valuable public resource and a major regional employer. Nonetheless, the city's statistically low performance in educational attainment presents a major hurdle in its economic restructuring. It deters regional investors in need of a skilled labor force from moving into the city. Furthermore, low educational levels go hand in hand with drug use and violent crimes.

Level of Internet Technology in the Community

Infrastructure and Service Currently Available

While UMass Dartmouth and other large institutions have up-to-date telecommunications services and infrastructure, smaller businesses and institutions in the area are not so well equipped. For example, the New Bedford Chamber of Commerce has requested, but not yet received, a DSL power-level upgrade. The Greater New Bedford Industrial Foundation is currently pressing for a campus-wide upgrade to its Business Park, which would give the park's tenants a greater marketing edge; the local telecommunications provider, Verizon (formerly Bell Atlantic), will provide upgraded service only on an individual user-by-user basis. These upgrades are for DSL-T1 lines, which have a bandwidth of 768 kilobytes per second (Kbs) to 1.54 megabytes per second (Mbs). The T1 power level is designed for those users who rely on the Internet to conduct business, transfer large files and documents electronically, have many people simultaneously accessing the Web and e-mail, and/or host their own Web site. Running a DSL-T1 line can often incur the additional costs of rewiring older buildings for adaptability. This can discourage businesses, especially smaller ones, from upgrading and pressure them to pursue other sites outside the old industrial city centers.

IT Businesses in New Bedford and Massachusetts

The information technology sector comprises a wide range of manufacturing, retail, infrastructure provision, and user services, from software and hardware design and manufacture to computer and telecommunications sales and service, information-retrieval, and financial services. In Massachusetts, this sector makes up 5.6 percent of total employment, while in New Bedford it is only 2.6 percent (see Figure 6). The state's concentration in this sector's employment is in software and infrastructure; by contrast, New Bedford's top IT employers are concentrated in equipment manufacturing (see Figure 7). Indeed, Massachusetts and New Bedford share only two of the top ten sub-industries in this sector, computer and software stores and telephone communications—businesses that have a presence in nearly every town in the state.

Figure 6 - Information Technology Employment, Massachusetts and New Bedford, 2000

Massachusetts Total Employment	2,989,240
Total IT employment	166,877
Percent of Total	5.6
New Bedford Total Employment	32,403
Total IT employment	833
Percent of Total	2.6

Figure 7 - Top 10 Information Technology Industries Compared

Top 10 IT Industries, New Bedford and Massachusetts

New Bedford

		Total Employees	Percent of Total
1	Semiconductors and related devices	280	33.6
2	Metals service centers and offices	80	9.6
3	Electrical apparatus and equipment	73	8.8
4	Electronic parts and equipment, nec	64	7.7
5	Electrical work	60	7.2
6	Computer and software stores	39	4.7
7	Telephone communication, except radio	33	4.0
8	Electronic computers	28	3.4
9	Business services, nec	27	3.2
10	Computer-related services, nec	20	2.4

Massachusetts

		Total Employees	Percent of Total
1	Custom computer programming services	32,379	19.4
2	Telephone communication, except radio	15,612	9.4
3	Prepackaged software	14,917	8.9
4	Electronic computers	11,327	6.8
5	Computer-related services, nec	10,838	6.5
6	Computers, peripherals, and software	10,575	6.3
7	Electronic parts and equipment, nec	8,533	5.1
8	Computer peripheral equipment, nec	6,877	4.1
9	Radio and TV communications equipment	5,311	3.2
10	Computer and software stores	5,275	3.2

Source: iMarket, 2000

Potential for Economic Development Within the Current Infrastructure

New Bedford's business climate is not ideally suited to attracting Internet start-ups. Since 1996–97, New Bedford has had Internet cable service in addition to DSL service. Businesses are dependent on more than infrastructure, however. Critical factors include venture capital and entrepreneurship, political leadership, an attractive quality of life, and a high educational level, in addition to available land, tax incentives, equitable tax rates, a steady supply of water, and affordable electricity service. New Bedford lacks many of these qualities. The greatest obstacle to attracting Internet-based start-ups is an overwhelmingly low educational attainment.

Nonetheless, New Bedford's existing business clusters could greatly benefit from incorporating information technologies into their business models. Furthermore, New Bedford has great potential to attract back-office businesses serving information-technology concerns elsewhere. According to the South Coast Development Partnership, four principal industries have good prospects of offering New Bedford economic recovery: (1) marine science technology, (2) food processing and value-added agriculture, (3) finance and back-office (data processing) services, and (4) software and telecommunications.[47]

The fishing industry is a $3 billion market that could benefit enormously from the technological tools clustered in academic and research institutions. Furthermore, UMass Dartmouth and other educational institutions in the South Coast region provide a potential academic research pool of 75,000 students. The integration of area academic institutions with the fishing industry through C/MST[48] can provide the necessary instantaneous data streams for fishing and shipping. The Global Ocean Observing System (GOOS) can supply the fishing industry with data streams that match product availability and surplus with demand. An automated fish auction that pools all the major New

[47] "The Next Wave of Business Opportunity: A United South Coast Massachusetts," in *The Next Wave: News from the South Coast Development Partnership.* Chancellor's Office, UMass, Dartmouth.

[48] C/MST, a public institution affiliated with UMass Dartmouth, performs highly advanced research operations. It administers studies of the ocean floor through mapping technology, using submarines and advanced laser technology. It also studies the daily affects of tidal patterns and phenomena such as "red tides." All of these research initiatives also consider the effects of the marine environment on marine-based economies.

England seaports and coordinates daily catches with the demand from suppliers not only makes for cost efficiency, it has the potential for use as a conservation tool: fishing only what the market demands prevents unnecessary catches.[49] The challenges in this arena will involve determining how to use the currently available telecommunications infrastructure most efficiently.

In the area of food processing and value-added agriculture, Luso Food Service is currently the only New Bedford food processor using e-commerce in its operations. However, by exploiting the telecommunications infrastructure and adopting new business practices, businesses in the food and agriculture sector have the potential to reinvent themselves. This includes changing supply-chain and distribution relationships.

Manufacturing is woven into the urban fabric of New Bedford. Historically the foundation of its prosperity, it is a strong part of New Bedford's very identity. Manufacturing is, and will remain, the city's economic backbone. Increasing the competitive ability of New Bedford's factories, as well as its service industries, through better information technology use is essential for the city's advancement.

Manufacturing industries in New Bedford benefited from $87 million of new investment in 1998 and 1999. This inflow of capital was used to install new equipment, hire more employees, and facilitate business expansion. Tax increment incentives and support from the New Bedford Economic Council are also helping the city's manufacturing industries establish their goals and meet their objectives.[50] The recent upswing in investment goes hand in hand with the potential of New Bedford Harbor not only to retain and increase its manufacturing components but also to generate spin-off enterprises.[51] The Harbor's working waterfront, its ferry service to Martha's Vineyard, its boat building and repair

[49] The two major Massachusetts seaports are Gloucester and New Bedford. Of the two, only Gloucester is currently operating with an automated fish auction up-link, via DSL. New Bedford, although serviced by both DSL and Internet Cable, still operates by telephone.
[50] The New Bedford Economic Council is a non-profit organization under a contractual agreement with the city.
[51] For every new manufacturing job, nearly three spin-off jobs are created. These include employment in the SIC divisions of Services, Retail Trade, Wholesale Trade and Agriculture, Forestry, and Fishing.

shops, and its pleasure-boating amenities all work to secure New Bedford's appeal to new investors.

According to Jim Mathes, president of the New Bedford Chamber of Commerce, developments in manufacturing over the past two years have been accompanied by an increase in employment in the high-technology sector, particularly in medical services and marine instrumentation. New Bedford has the telecommunications infrastructure and a demand from potentially heavy users, emerging most significantly out of its manufacturing-based initiatives such as the South Coast Development Partnership and programs at UMass Dartmouth. The question remains how users will utilize technology: a communications relay, a marketing- or sales-oriented platform, an extension of education and research initiatives, or a combination.

There is no evidence that telecommunications has gained any more prominence in the city's vision for economic recovery. This is primarily due to the low level of educational performance, which the city feels must be resolved first. It is perhaps ironic that an important tool in closing the education gap will be technological teaching aids, provided through the telecommunications infrastructure.

Industries that have been making good use of telecommunications and IT are strong or growing in New Bedford. Financial companies, for example, have been pioneers in the use of telecommunications. With the right infrastructure and increases in educational attainment, New Bedford can continue to attract back-office services. The same applies to the health-care industry, which already has a strong presence in the city. The new focus on tourism also begs for an IT strategy in the city, as many people have started making their travel plans on-line. None of this can be done, however, without education providing basic IT skills to New Bedford citizens.

Current and Potential Users of Technology

Currently, several types of institutions and businesses are heavy IT users and require high-capacity infrastructure. These include the University; corporations, especially tenants of the Business Park and financial-service businesses; and health-care providers.

The telecommunications demands of the University of Massachusetts, Dartmouth range from student and faculty Internet access to the telecommunications-dependent university-affiliated institutes, both existing and planned. Important among the latter are two marine science facilities, the School for Marine Science Technology (SMST), which is preparing to expand into the ten-lot marine research subdivision in the former United States Navy facility next door; and the Science Education and Economic Development (SEED) Center that will be incorporated into the New Bedford Aquarium. To date, SMST has not been using high-tech telecommunications to their full potential, partly because it hopes to create a technologically seamless relationship between itself and the Aquarium through the SEED program.

Other university programs that will require new levels of IT support are the Intercampus Graduate School in Marine Science and Technology (IGSMST), the College of Visual and Performing Arts, and the new E-Commerce Center, a proposed University affiliate in New Bedford. The center will assist business executives with e-commerce development, on-line business tactics, and research skills, conduct unbiased scientific studies, and assist small-business start-ups with “turn-key” services, from setting up Internet service to developing a Web page.

The other primary generator of intense demand for telecommunications services is the business sector. This applies particularly to the firms located in the New Bedford Business Park, located on 1,300 acres at the north end of the city. Individual sites range from 5 to 65 acres, with over 300 acres available for sale. Among the park’s high-profile tenants are Aerovox, Polaroid, and Titelist. Once stagnant and with dim prospects, the business park appears to be turning around. With the hiring of a new executive director in 1998 and a zoning upgrade to a mixed-use business park, the area has been revitalized.

Lot sales have increased, and the park, once handicapped by its original industrial and manufacturing zoning designation, is becoming one of the hottest business centers in Massachusetts. Incentives for businesses to locate in the park include large property-tax discounts and a 5 percent state investment tax credit, location off a major highway, and recruiting assistance, as well as labor costs of 10–25 percent below those in the greater Boston area and 40 percent below those in New York City.

The park currently employs 4,000 and expects to increase that figure to 10,000 in the next five years. Future amenities will include a hotel; an early-childhood development center with staff fluent in Portuguese, Spanish, and Creole; an exercise facility; and an upscale restaurant, all in a beautiful park-like setting that will further encourage future investment. The increased marketing potential of the park has been accompanied by $750,000 in road improvements, landscaping, and signage.

A T1 telecommunications infrastructure upgrade is available, utility infrastructure ducts have been installed throughout the park, and COM/Electric plans to increase circuit capacity. Two of the South Coast region's heaviest users of telecommunications technology are also its providers: AT&T, which employs 1,000 at its Fairhaven headquarters, and the Verizon telephone switching station in New Bedford. The Verizon station is crucial to anchoring and preserving a telecommunications infrastructure foothold in New Bedford; it must maintain its strategic location in order to provide Martha's Vineyard and Nantucket islands with telephone service.

Compus Bank provides a good example of a financial institution with heavy IT usage. The bank went public this year and moved its headquarters into a new, $20 million facility in downtown New Bedford, where it employs 275 people. Further employment growth has been projected and planned for. Compus Bank currently utilizes a DSL-T1 line with a shared bandwidth for voice and data transfer. The bank's telecommunications system has been designed with a great deal of redundancy in order to provide seamless and uninterrupted service. To avert the risk of a network-wide shutdown, each of its 40

branches communicates directly with the U.S. Bank Corporation and with National Cash Register, in Framingham, which handles the bank's data processing.

In the health-care sector, South Coast Hospital Group, including Saint Luke's, has been using the telecommunications infrastructure for teleconferencing. Whether and to what extent the potential of high technology will be applied to research-oriented activity remains to be determined.

The lowest level of telecommunications use in New Bedford is in older and smaller retail businesses and in private residences. Holding to traditional, outmoded business practices contributes to the low level of telecommunications use in the first category. It has been suggested that high unemployment and low educational attainment account for low domestic use. Some add low esteem in the community, which includes a large number of Portuguese, Guatemalan, Mayan, and Cape Verdean immigrants.[52] However, executives of textile manufacturing and value-added agriculture firms discount the importance of the labor force's educational level as a determining factor, giving much more weight to the cost and availability of Internet service.[53] In any case, educational attainment and other demographic indicators do handicap the growth potential of other industry sectors, such as finance and back-office services and software and telecommunications firms, which require a skilled, educated labor force to make efficient use of the available telecommunications infrastructure.

Local Action to Address Technology Development

New Bedford is currently undergoing a master planning process. In addition to efforts to revitalize the downtown, the city and region have initiated programs to support and increase business know-how, including new-technology concerns. One public-sector effort, the "MBA (Meaningful Business Acumen) in a Day" program, is a joint undertaking by the New Bedford and Fall River chambers of commerce. It is intended to

[52] Ironically, the high concentration of immigrants also makes for the strong work ethic that has contributed to New Bedford's economic development and its reputation for high productivity in the manufacturing sector.
[53] "The Next Wave of Business Opportunity."

build the competitive edge of small businesses in the two cities. The program will be launched in spring 2001 with five seminars addressing the areas of public speaking, business technology, international trade, Web-site building, and customer service.

Several business incubator sites are being developed with the aim of creating public centers of research and education. These sites can be thought of as high-tech community centers. The first of these is the high-tech incubator planned for the former Standard Times building in downtown New Bedford. The project was initiated and has been managed by the New Bedford Economic Council. The incubator will provide job training for finance and back-office services, marine sciences, value-added agriculture, software and telecommunications, and manufacturing research. The center will offer instruction in an array of skills, from improved manual dexterity to following detailed instructions to operating a computer.

The incubator, composed of more than 20 public and private organizations working cooperatively, is funded through public-sector grants and backed by a dozen manufacturing firms in the region. The public institutions currently associated with the program are Bristol Community College in Fall River, Greater New Bedford Regional Vocational Technology High School, New Bedford Public School System, New Directions (a computer literacy program that teaches basic skills and specific applications), and the Massachusetts Department of Employment and Training (DET).

Several business and business/academic partnerships have also been formed to address the region's barriers to technology development. One of these is the Early Childhood Education Center in the business park, discussed above, which has been privately generated by the Greater New Bedford Industrial Foundation. Others include New Directions and the South Coast Educational Compact, a volunteer consortium of school committees, parents, businesses, and other interested groups, designed to offer school-business partnerships to create internships, externships, and a region-wide report card.

Two notable programs are helping to foster regional relations among the universities, the town of Dartmouth, and New Bedford. The South Coast Development Partnership is a 15-member organization that is addressing region-wide issues of economic development. UMass Dartmouth has provided the facilities and staff support for its various initiatives, as well as functioning as a facilitator and catalyst. The organization South Coast CEOs is composed entirely of private-business executives, although it is tied in to the University of Massachusetts through its the program head in the UMass Dartmouth chancellor's office.

Local Lessons and Recommendations

New Bedford is in the midst of a major transition. In the next few years, its economy will be transformed by new initiatives, as new ventures come to the city and established businesses learn how to exploit new technologies. The challenge will be to maintain and improve the competitive edge of the city's traditional manufacturing base while introducing fresh ingredients into the business mix. Among the most important of these new elements are tourism and high-tech companies, both large and small.

Telecommunications is not an end in itself, but investment in infrastructure and high-tech start-ups is critical to the revitalization of this economy. It has often been said that money and water know no boundaries. The same applies to telecommunications. The South Coast region is a critical sub-center of Boston, Providence, and even New York City. As such, it must match these cities' telecommunications capacity if it is to improve, or even preserve, its present economic position. This point is vividly illustrated by the fact that the state of Rhode Island sees its primary economic "catchment area" as including all of Connecticut, Massachusetts, southern New Hampshire and New York City: It will do whatever it can to create a climate of competitiveness that matches the telecommunications investments in these areas. New Bedford is less than 40 miles from Providence and is well within its commuting range.

The lesson here is that cities and regions that wish to compete in the high-tech world must be prepared to invest. In the case of New Bedford, with a large segment of low-income families, this requires a sacrifice. It means investing in an unknown future while continuing to serve current pressing needs. The city must plan carefully and invest steadily. If nothing else, the telecommunications revolution has reinforced the need for cities to employ meaningful capital-improvement planning and programming. New Bedford, has been slowly moving in this direction, but there are signs that the momentum is increasing.

There is a strong entrepreneurial spirit in New Bedford, with new companies being formed regularly. Most of these are small and will stay small, but almost all will require modern telecommunications if they are to prosper. It is essential that opportunities be created, through planning and zoning, for these small companies to succeed. After all, locally funded companies tend to stay local.

Telecommunication systems, while undeniably direct economic instruments of great importance, must also meet the needs of all citizens. This means that plans must be developed to ensure that not only businesses but schools, homes, hospitals, senior centers and other community institutions are totally connected. These efforts must include meeting the needs of our newest immigrants plus the poor, the unskilled, and the elderly. The primary and secondary school systems must also meet the challenge of educating the rising generation to a level commensurate with the demands of the information age. This will be no easy task, but upon its outcome the city's future will rise or fall.

Finally, telecommunications planning cannot involve just one or a few groups and organizations in the city. It must involve the private sector, the investment community, higher-education institutions, and government at all levels.

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Case Study:
Roxbury

Contents

Overview

Roxbury is an urban community made up mainly of racial and ethnic minorities with below-average incomes. However, the community does have access to a high-end technological infrastructure and contains a smattering of e-commerce businesses. Nonetheless, the technological infrastructure has not yet allowed for widespread economic development in this neighborhood. It is for primarily socio-cultural and socioeconomic reasons that Roxbury has not taken full advantage of this link between the technological infrastructure and potential economic development. As will be seen later, a few examples of positive economic development initiatives linked to the technological infrastructure can be found, but this potential has not yet been fully tapped.

In looking at the "digital divide" in relationship to the neighborhood of Roxbury, it is important to consider the nature of this divide. The term was popularized by Larry Irving, former U.S. Department of Commerce Assistant Secretary for Telecommunications Policy. It refers to the gap between those who have access to the telephone, personal computers, and the Internet and those that do not. Those without access tend to be residents of rural communities, racial and ethnic minorities, and those with lower incomes.

Our examination of the digital divide in Roxbury will consider several elements. These include the digital divide's relationship to, and impact upon, educational attainment, including the importance of early access to technology; the reliance of Roxbury's economy on the social-service industry; and the overall effects of the digital divide in Roxbury, including the potential for closing this divide in the near future. There will also be some discussion of local and national initiatives that may assist Roxbury.

The Boston neighborhood of Roxbury is located near downtown and adjacent to the South End. A significant proportion of its population is African-American, Latino, and of Caribbean descent. The 1995 population of Roxbury was 59,646, of whom 37,692 (63

percent) were African-American, 13,505 (23 percent) were Hispanic, 6,380 (11 percent) were white, and 2,069 (3 percent) were Asian. The projected population in 2005 will be 63,362, with the African-American population remaining at 63 percent while the Hispanic population will jump to 29 percent.

Roxbury is a rather densely populated residential community. Victorian mansions stand alongside subsidized apartment buildings. The neighborhood has a high rate of poverty, a large number of single-parent household, and the highest rate of teenage pregnancy in the city. Average incomes, educational attainments, and voter registration and participation lag behind other primarily working-class neighborhoods. Roxbury is also, in general, a younger community than other Boston neighborhoods.

The three top occupational categories for Roxbury, according to March 1993 Boston Redevelopment Authority (BRA) data, are service occupations, administrative support, including clerical, and professional specialty. According to the BRA report, the median household income in Roxbury in 1993 was $20,518, with per-capita income of $11,295 for white residents, $9,845 for African-Americans, $6,722 for Asians, and $6,138 for Hispanics.

The BRA data on educational attainment indicate that 30 percent of the Roxbury population 18 years or older have high school diplomas, 12 percent have either associate's or bachelor's degrees, and only 4 percent possess graduate or professional degrees. Clearly, there is a need to encourage education beyond the high school level if Roxbury is to take full advantage of the new knowledge-based economy.

As has been the case in cities around the country, Roxbury over the past 30 years has been losing its middle class to other neighborhoods in the city and to the suburbs. This has been particularly true of the African-American population, who benefited from the gains won in the civil rights struggle. As social mobility became more possible, inner-city communities like Roxbury experienced something akin to a "brain drain." Middle-class residents left for other areas, the inner cities lost their homeowners and business owners,

and the communities began to drift as their anchors moved away. Simultaneously, disinvestment left the residential, commercial, and retail sectors weakened. The past few years, however, have seen re-investment in Roxbury, ranging from Dudley Square to CrossTown Center to Grove Hall. Roxbury's geography works in its favor, given its proximity to downtown Boston, Back Bay, Beacon Hill, and its adjacency to the South End and Jamaica Plain.

Roxbury residents work primarily in health services, finance, insurance and real estate, retail trade, educational services, and public administration. According to the BRA, of employed persons 16 years and older, the vast majority (13,188) work for private, for-profit companies in both wage and salary positions. A lesser number (2,632) work for private, not-for-profit firms. Local government employs 2,153 Roxbury residents, the state government 1,788, and the federal government 818. There are 785 self-employed workers in Roxbury.

The health-service workers live in close proximity to several medical facilities, including the Boston Medical Center, BU Medical Center, the Longwood medical facilities, medical facilities in Chinatown, and several neighborhood health centers in Roxbury and adjacent communities. Major universities are also close to Roxbury, including Northeastern University, the Wentworth Institute, Suffolk University, and the University of Massachusetts, Boston, as well as Roxbury Community College.

Because of its central location, Roxbury has long been looked upon as the next area for gentrification after the South End. It is also near the medical districts at Longwood, the South End, and Chinatown. Clearly, the development potential for Roxbury is great. However, given Boston's long history of racial division, Roxbury has been viewed as a step-child within the city. A widespread public perception of high rates of crime and violence has plagued Roxbury over the years.

Yet, despite these perceptions, there have been several positive economic development initiatives in Roxbury over the past 25 years. These have included the Massachusetts-

based computer giant Digital Equipment Corporation building a plant in Roxbury's CrossTown Industrial Park in 1980—the first Fortune 500 company to build in Boston's inner city since World War II. This high-tech company remained in Roxbury until 1993, when its larger financial problems forced plant closings around the country, including the Roxbury plant. This site is now to become CrossTown Center, a mixed-use $100 million development.

In 1989, a biotechnology center was created in CrossTown Industrial Park, with Boston University Medical Center as the tenant. The move to Roxbury made strategic sense—the BU Medical Center campus is just down the street, in the South End—and also showed the economic potential of Roxbury for both high-tech and biotech ventures.

More recently, considerable revitalization activity has been taking place in historic Dudley Square. The Massachusetts Department of Public Health (DPH) is planning to move 1,400 workers into renovated quarters by the end of the year 2003. Other office and retail developments now underway in Dudley Square will bring additional thousands of workers and shoppers into this historic district. In addition, a new fiber-optic line has been laid, which traverses Roxbury and Dudley Square as well as other neighborhoods in the city.

Despite this ongoing revitalization, however, Roxbury remains among the lowest-income, highest-crime, highest-poverty and lowest-voting neighborhoods in the city. A 1994 Urban Land Institute (ULI) report, which looked at the development potential of CrossTown Industrial Park, Dudley Square, and Orchard Park Housing Development, outlined the problems and possibilities of Roxbury. In a recently published report, ULI reviewed its 1994 survey and assessed the current state of these three areas of Roxbury. A 1995 Trotter Institute report concluded that Roxbury lags behind other areas of the city in computer utilization. One outcome of this study has been the formation of several community technology centers in Roxbury.

With the exodus of Digital from Roxbury in 1993, no major technology firm currently resides in Roxbury. The biotech center is still in operation in CrossTown Industrial Park, but its major tenant is Boston University Medical Center, along with two small commercial biotech companies. The larger biotech firms are located in the South End, in the BU Medical Bio Square project, only minutes from Lower Roxbury. The highly touted Boston Emerging Industry Center, located in CrossTown Industrial Park, never really got off the ground as a business incubator for biotech and new technology companies. Further, the Newmarket Industrial District, adjacent to CrossTown Industrial Park, lost out to the South Boston Seaport District as the site of a new $1 billion convention center.

The city of Boston is currently conducting a master planning process in Roxbury, which will be completed in spring 2001. The intent of this process is to help guide planning and development activities in Roxbury in the midst of a boom in the building of residential, commercial, and retail space in the community. Roxbury now stands to benefit from this upswing, as well as from the recent heightened interest in inner-city communities—witness the recent work by Michael Porter on the competitive advantage of the inner city and the profitable investments by Earvin "Magic" Johnson in cities around the country.

In the past, Roxbury has had mixed success in taking advantage of the technological advances that have boosted economic-development initiatives elsewhere. While its population density makes wiring and other technological infrastructure cost efficient, its relatively lower levels of income and home ownership work against Roxbury in the technological sphere. Access to the Internet and to personal computers remains low. Roxbury, therefore, still stands somewhat outside the mainstream in the world of e-commerce and Internet-based ventures. However, it is in such close proximity to the technology and venture-capital centers that are helping to drive this e-commerce revolution that the community should be able to position itself to take advantage of this development.

Community Context

Roxbury has a fairly strong recent history of local entrepreneurs understanding the relationship between technology and economic development. The development of facilities for high-technology and biotechnology ventures, both commercial and university-based, is proof of this level of understanding. In addition, the close geographic relationship between the South End, where Boston University has built impressive facilities for biotech and other technology-based operations, and Lower Roxbury, along Albany Street, has helped facilitate this technology penetration.

In a recent article, the *Boston Globe* highlighted the developments along Albany Street and depicted this area as a sleeping giant, containing both technology-based and commercial opportunities that should lead to positive growth. This potential encompasses both the South End and the Lower Roxbury ends of Massachusetts Avenue. The two public housing projects in closest proximity to these two sides of Mass. Avenue, Orchard Park and Cathedral, have seen recent dramatic changes in their appearance as a result of extensive renovations.

At this time, technological penetration is still primarily at the institutional and corporate level and has yet to "trickle down" to the residential population. However, institutional participation in increasing the residents' technology base is underway. Digital Equipment Corporation was one of the first to initiate a program of donating hardware and software to local non-profits, both for their own operations and for the establishment of community technology centers.

Because of their population density and favorable geography, Roxbury and North Dorchester were among the first neighborhoods in the city wired for cable television, back in the 1970s. For the same reasons, these communities should also benefit as the telecommunications infrastructure essential to the new technologies is being laid.

The vision that technology could be connected to economic development in Roxbury also goes back to the 1970s, when it was expressed by several community leaders. Among these were Archie Williams and Marvin Gilmore. Williams ran a high-tech company with ties to Raytheon. He was ahead of his time and continually battled to keep his company afloat. It was difficult for Williams to secure the support of local banks and the downtown business establishment in his efforts. Gilmore heads a local community-development corporation, which was responsible for bringing Digital Equipment Corporation and the biotechnology center into CrossTown Industrial Park. Economic Development Administration funds were a critical piece of the financing package for both projects.

At the time, most development activity in the community was directed toward creating affordable housing, which was being built by both for-profit and non-profit developers. There was not only a need for affordable housing, but funding was available for such programs. Funding for commercial developments, particularly high-tech-oriented ventures, was difficult to find and took years to piece together.

However, given its favorable location, both within the city and in relation to the regional highway system, particularly its ready access to the technology centers within Boston and on Route 128, Roxbury's potential as a technology hub has long been recognized by key leaders. The establishment of the Digital plant in the industrial park in 1980, and of the BU biotech center in the late 1980s, were spurred by its prime location.

A few Internet-based companies are already located in Roxbury. Generally, they are very small businesses with few employees. However, there is great potential for such businesses to grow and flourish in Roxbury given the right set of circumstances. Other areas of the country have seen minority-owned Internet companies launched with greater fanfare than those located in Roxbury. NetNoir, perhaps the oldest dot-com company with an African-American focus, was launched in San Francisco in 1995 with backing from America Online (AOL), and recently celebrated its fifth anniversary with a series of high-profile celebrations in cities around the country. Black Entertainment Television

recently launched BET.com, intending to take advantage of its 20 years of content development oriented to the black consumer market. Among the backers of BET.com are Microsoft, USA Networks and Liberty Digital. Magic Johnson is in the process of launching UrbanMagic.com, with Larry Irving as CEO. UrbanMagic.com has backing from the web development company Guidance and from United Talent Agency, in addition to Magic Johnson Enterprises.

With 5 million African-Americans regularly cruising the Internet, Web entrepreneurs are hoping to duplicate the success of BET in the cable television arena by serving the long-neglected black consumer market. BET is now an established brand name, with a market value of over $1 billion. Roxbury has the potential to be the home of a similar success story.

Richard Walker, a Roxbury resident and MIT graduate, was one of the first African-American engineer-entrepreneurs to found a technology-based company. Walker came from a small town in Kansas and attended MIT in the 1940s. He founded Microwave Associates in the 1950s and M/A-COM the following decade. M/A-COM went public in the late 1960s. Walker was good friends with Otto and Muriel Snowden, co-founders of the Freedom House in Roxbury. In the 1980s, Freedom House, with the assistance of Digital, established one of the first community technology centers in Roxbury. After his company went public, Walker moved to Chestnut Hill, an upscale suburb of Boston, but retained his close ties to Roxbury. He passed away at age 64 in the mid-1980s as one of America's pioneer African-American high-tech multimillionaires. His influence on a critical mass of Roxbury residents was important in nurturing the possibilities of technology in business and economic development.

The current and future technology needs of Roxbury correlate well with the development of expanded Internet capability. As has been pointed out by some of those concerned with closing the digital divide, it is more of an economic issue than a racial issue. This reality becomes more constricting in the case of Roxbury because of the combination of its low median income and the virulent racism that is part of Boston's history. The

business formation rate in Roxbury is lower than in most other neighborhoods in the city, witness the BRA statistics detailing the low numbers of self-employed in Roxbury. Only recently have banking institutions begun aggressively courting Roxbury businesses and homeowners. Equity capital is virtually nonexistent in Roxbury. It has been the venture-capital community that has driven the e-commerce success.

One goal of the weakened Emerging Industry Center was to establish a venture-capital fund based in CrossTown Industrial Park. Although this never came to pass, the idea remains valid. Similar communities have shown that this is possible. For example, in South Los Angeles, the First A.M.E. Church is opening a new technology business incubator in November of 2000 with a $20 million venture fund. Granted, this amount is miniscule compared with the flow of mainstream venture capital, but it represents a valuable first step in the process of seeding a knowledge-based industry.

Level of Internet Technology

With the concentration of new development projects and older ones now in operation within the one-mile quadrant containing Dudley Square, CrossTown Industrial Park, and the South End, a significant infrastructure of commercial, retail, biotech, high-tech, and utility facilities now exists. This infrastructure, in concert with the current cable, telephone, fiber-optic, and utility connections, can leverage this area of the city into a position as a premier center for new technology ventures. What's more, the concentration of universities nearby and in the metro Boston area makes the potential for technology transfer out of university laboratories into commercial applications considerable. This was the thinking behind the Boston Emerging Industry Center, whose potential was hamstrung when it became tied up in local politics, but the vision of such an emerging industry center tied to e-commerce and Internet applications still has tremendous viability.

Because of its geographic location within the city of Boston, Roxbury has the same level of access to telecommunications and Internet technologies as do adjacent neighborhoods such as the more affluent South End. The telephone technology is comparable. The same applies to access to cable television. As noted earlier, Roxbury was among the first neighborhoods in the city to be wired for cable. Access to ISDN and DSL is also comparable. Further, a new fiber-optic loop connects Roxbury and other parts of the city.

However, primarily for socio-economic reasons, Roxbury lags behind neighborhoods such as the South End in the utilization of these services; even the percentage of homes with telephone service is lower, and those with ISDN and DSL lines are fewer still. And as noted in the 1995 Trotter study, computer ownership and use in Roxbury is below average. This technological gap provides a measure of the width of the digital divide.

Conversely, communities such as Roxbury, with a large number of African-American and Hispanic households, tend to view television more hours per week than do white households. In the early days of television, in the 1950s, black households were less likely to own TV sets and thus less likely to watch television. Like the digital-divide issue of today, access to TV tended to be an economic issue more than a racial question, though the racial divide was then and remains critically important. In the 1950s, if a black family owned a TV set (and those who did tended to be middle class), the neighbors would gather around that one set and it became a communal viewing experience. That experience is paralleled in today's community technology centers.

If the history of television accessibility is repeated in the high-tech age, we will see black households, after initially lagging behind white households, gradually close the gap and perhaps, in the not too distant future, even exceed white households in access to Internet technology. This is what African-American Internet entrepreneurs such as NetNoir, BET.com, and UrbanMagic.com are banking on.

Just as the 1995 Trotter Institute study showed an underutilization of computer technology in Roxbury, the 1999 U.S. Department of Commerce report "Falling Through

the Net" showed a nationwide gap between more affluent and less affluent communities in access to and utilization of the Internet and personal computers. Black and Latino households were found to be less likely to have access to the Internet and personal computers than white and Asian households. In response to this finding, there has been an increase in the number of community technology centers in communities like Roxbury. In these centers, usually located in churches or other local non-profit agencies, banks of computers are made available to community residents. The hardware and software are often donated by corporations, and are often secondhand.

However, funding for such centers often comes private foundations as well. As of December 31, 1999, the Timothy Smith Fund had authorized grants totaling $1,370,000 to 35 non-profit organizations in Roxbury for the creation of Computer Learning and Educational Centers at their facilities. Grantees use the funds to acquire state-of-the-art computers and to properly outfit each center with computer peripherals (printers and scanners) and furnishings (workstations and adjustable chairs). The centers' computers are connected to an internal network through a server and externally to the Internet. The average center has twelve computer workstations, two printers, one scanner, and a digital camera.

The Smith Fund's goal is to create a series of integrated computer centers throughout Roxbury by the end of the year 2000 and thereafter to endow these sites and continually upgrade the centers' computer hardware and software to ensure their state-of-the-art status through the year 2019. According to the Smith Fund, 35 centers have now been funded and 18 are already operational. A total of 450–500 computers are now available for public use, with an estimated one million hours of computer time available annually.

More affluent communities are more likely to have personal computers and Internet access in the home. While communities such as Roxbury have become quite creative with limited resources, lack of domestic access to technology is a disadvantage in today's world. If communities like Roxbury are to successfully compete in the new economy, access for residents will have to increase. In Roxbury, the availability of technology is

not the problem. The problem is rooted in economic disparities and racial divisions, as well as a lack of education about the need for technology training and income and wealth creation. More youngsters in Roxbury are interested in becoming the next Michael Jordan than the next Michael Dell.

There are more community technology centers in Roxbury than there are e-commerce-related businesses. This is consistent with the history of communities such as Roxbury, where business development has stagnated in the past 40 years and the social-service model has prevailed in its stead. One area in the new technology arena where African-Americans have worked for years is the telephone company. More recently they have found a home in cable television. What is needed now is a move to employment in the e-commerce sector. What is even more vital is a move into business ownership in that sector. Jobs and income are necessary if residents are to participate in the dot-com economy. Perhaps even more important at this time is wealth creation via business ownership. The ghost of Richard Walker still hovers over Roxbury. Nearly 50 years ago he was a business pioneer in a new technology, microwaves, and he created wealth, jobs, and income in the process. Roxbury is still looking for this generation's Richard Walker.

Just as the level of technology available to domestic users in Roxbury is competitive with adjacent communities, so is its availability to commercial operations. Cable lines, fiber-optic lines, and access to ISDN, DSL, and T1 lines make Roxbury businesses just as technology ready as firms in any urban area. The biotech and high-tech tenants in CrossTown Industrial Park have access to the latest technological equipment, which enables them to compete with similar operations in more affluent locales. That there is not yet a critical mass of new-technology firms in Roxbury is due a variety of reasons. One is that the area is still labeled as "dangerous." Another reason is that new-tech companies have not been wooed to the area with the same intensity as other locations. A third reason is the lack of both debt and equity investment in new-tech ventures in this neighborhood.

On the governmental side, the new Police Headquarters has added a state-of-the-art facility to the Roxbury landscape. This new facility, which was designed by a minority architect and built as a joint venture by a minority and majority general-contracting team, has all the latest technological crime-fighting "toys" at its disposal. It is connected to all the other relevant crime-fighting operations in the metropolitan Boston region via land lines and wireless technology.

Roxbury's civic center is currently in need of some updating of its facilities, including the Area 9 Police Station and the Boston Public Library branch. A local design firm is completing a review of the capital needs in this area, which will include technology needs as well as brick-and-mortar requirements. New governmental building projects now in the pipeline will keep the pressure on to make Roxbury's technological infrastructure competitive. In addition to the new quarters for the Department of Public Health in the Ferdinand Building in Dudley Square, the Social Security Administration will soon move from its present location in Dudley Square to an upgraded site at the new Fairfield Building, now under construction in the square. Both these public agencies will require technological infrastructure of the highest order.

The Boston Water and Sewer Commission is currently building new headquarters on the site of the former Stride Rite facility in CrossTown Industrial Park. The commission has dedicated about one-third of the facility's 500,000 square feet to community economic-development uses. Some of these could well be related to new technologies, such as housing Internet-based ventures. A working group of local community-development and business-development interests has been meeting to evaluate the best ways to work with Water and Sewer to maximize the use of this space.

While it is difficult to pinpoint a causal relationship between technology and economic development, Roxbury has seen the establishment of technology-based ventures within its borders frequently enough over the past twenty years to understand its significance. Nonetheless, the bulk of development in Roxbury is not currently technology based. In addition, much of the housing being built in Roxbury is still subsidized, increasing the

likelihood that the community will continue to be characterized by economic deprivation. As long as Boston's affordable housing is concentrated in Roxbury and North Dorchester, the digital divide will be even more difficult to close.

However, the potential has been grasped, albeit on a small scale. The level of education and training related to the high-tech and biotech presence in Roxbury has been significant. Indeed, the very presence of such firms in Roxbury is a signal achievement. The greatest stumbling block remains Roxbury's status as a second-class citizen among Boston neighborhoods. How to overcome this obstacle is a huge challenge for the leadership of Roxbury and the city of Boston.

One area in which Roxbury-based and minority businesses have made headway in the Boston economy is in design and construction services. Indeed, the leading minority construction company in the city, Cruz Construction, is a family-owned concern located in Roxbury. This successful company, now being run by the second generation of the Cruz family, recently received designation from the Boston Redevelopment Authority for the former Modern Electroplating plant in Dudley Square. This brownfields site is slated to be demolished and rebuilt as the home of the Cruz company, in addition to housing other office and retail space.

Although mostly devoted to creating residential communities funded by government entities, Boston's minority-owned design and construction firms have managed to find a market niche. An outstanding example is the participation of minority investors in One Lincoln, a 36-story tower in Boston's financial district—the first time in the nation's history that a group of minority investor-developers will participate in building and owning a downtown skyscraper.

This historic event also signals an opportunity for brick-and-mortar professionals to do business in cyberspace. This is no easy task, as noted by Warren Lutz in the August 2000 issue of *UrbanLand.* Lutz points to a growing number of architects, designers, brokers, and contractors who are using the Internet to handle property deals, find labor and

supplies, and manage projects online. In the world of design and construction, time is money, and the Internet has proven to be the fastest and most efficient way of bringing all the information, documentation, and people together in one place. But, Lutz notes, the idea is slow to take hold.

Construction industry e-commerce appears to be a fast-growing market, and several specialized e-commerce companies have sprung up to fill the growing need. According to Cambridge-based Forrester Research, only $6.3 billion of the industry's business is currently conducted online. By 2004 that number is projected to grow to $141 billion. These sorts of predictions are fueling the growth of construction-related Web sites. For example, six months after being launched, Buzzsaw.com (an outgrowth of the California-based engineering and design software firm Autodesk, Inc.) had already secured nearly $90 million in venture-capital funding.

But it remains difficult to get a brick-and-mortar crowd to do business in cyberspace. While one of the biggest obstacles is simple fear of the unknown, a more practical barrier is the need for better Internet transmission speeds through DSL or cable lines, which would make it possible to send large project files over the Web.

The problem of moving design and construction professionals into cyberspace mirrors that of moving a community like Roxbury into cyberspace. Ignorance is one problem; appropriate technology is another. As a business development opportunity, given the inroads made in Boston by minority design and construction professionals, it is perhaps appropriate to look at the need for a Web-based project management service. It would even be sweeter if such a business could be located in Roxbury.

Technology in the region is headed in a direction that will keep metro Boston at the top of the pecking order in terms of access and infrastructure sophistication. Utilization rates in Roxbury at the household, commercial, and governmental levels should also continue to grow. The challenge will be to raise the rates of access to and utilization of the Internet in less affluent households and

commercial enterprises. Community technology centers are one answer to the problem, but clearly not a fully adequate one. If the digital divide is primarily defined as an economic chasm, then a concerted effort at income creation and wealth creation in a community such as Roxbury will bear fruit. Particularly in a time when the economy is robust, it is imperative to bridge this digital and economic divide before an economic downturn hits and dampens the enthusiasm for technological and economic reform.

Users and Potential Users of Technology

In examining the users of technology in Roxbury it is important to keep in mind that the local economy is largely driven by social-service agencies, governmental agencies, community-development corporations, churches, and, to a lesser extent, small businesses. The bulk of small businesses located in Roxbury are of the "mom and pop" variety. There are no major IT companies located in Roxbury. The new-economy companies located in Roxbury are small and very few. The major users of the Internet and PC's are the various social-service agencies, such as Morgan Memorial Goodwill Industries, Dimock Community Health Center, and the Urban League of Eastern Massachusetts. The annual budget for a few of these agencies approaches $20 million, and their employee base is sometimes over 300. Few, if any, private businesses in Roxbury approach these figures. In addition to the social-service agencies, the other major users in the area are the big medical centers. These include Boston Medical Center, on Massachusetts Avenue straddling Lower Roxbury and the South End; Boston University Medical Center, in the South End, which occupies two new buildings and a parking garage at BioSquare; and the BU Medical laboratories at 801 Albany Street, in CrossTown Industrial Park. A couple of small biotech companies occupying incubator space at 801 Albany are also IT users. Researchers at 801 Albany Street are tied into the main BU Medical campus on an Intranet system. The Internet, in turn, connects these research labs to institutions such as the National Institutes of Health, as well as to the venture-capital community.

Verizon (formerly Bell Atlantic) is also well positioned in Roxbury. The phone company shares space with the Urban League on Warren Street. Cablevision has long had a community access studio in Roxbury, which is also the site of one of the community technology centers funded by the Smith Fund.

On the northern border of Roxbury is Northeastern University, whose administrators, faculty, and students are heavy IT users. The university also owns the Renaissance Park building on Parcel 18 in which Whittier Street Health Center is located. This building is currently being wired to connect it with the rest of the university. Just down Tremont Street from Northeastern University is Roxbury Community College. RCC has not yet reached the necessary level of sophistication access to the Internet and the widespread availability of computers. Community colleges generally lag behind major universities in this regard. Thus, RCC falls into the category of potential IT users.

Other potential IT users are those businesses that will develop around the new DPH facility in Dudley Square, as well as the planned $100 million mixed-use CrossTown Center, being developed just across the street from 801 Albany Street in the industrial park. Indeed, the revitalization of both these areas is expected to encompass not only bricks-and-mortar modernization but also technology upgrades.

The Empowerment Center and the Small Business Administration (SBA), both currently located in the old Digital Equipment Corporation plant in CrossTown Industrial Park, are moderate IT users. They will be relocated when the CrossTown Center project begins construction, as this building is slated to be demolished in the process. Both these agencies have Web sites, as does the branch library

The potential for private household use of the Internet and PC's is enormous. Currently, Roxbury is an underserved market. In line with Michael Porter's thesis of the inner city's competitive advantage, Roxbury represents a consumer market with an annual $3.5 billion purchasing capacity. It is a community underserved by supermarkets, pharmacies,

and other high-end retail services, and overserved by liquor stores and check-cashing services.

Because Roxbury, like similar communities nationwide, is so underserved in this regard, entrepreneurs are beginning to line up to service this market as it expands in the future. Dot-com and e-commerce ventures expect to provide both content and retail services to the black consumer market. In doing so, such ventures will have to be sensitive to this market's unique needs. BET and Univision are but two examples of companies successfully reaching the black and Hispanic markets, respectively, via the television set.

Local Action and Recommendations

Roxbury is a community with income and education levels below the city of Boston average. It is perceived as being crime-ridden and dangerous. It has long been neglected in terms of city services. And yet, Roxbury remains a community with vast potential. It has a superior location within the city of Boston. It is well supplied with green space and leafy trees, and boasts many graceful homes. As a densely populated neighborhood, it wields considerable purchasing power, despite having relatively little disposable income. As the new economy grows and develops, Roxbury has the potential to move into the forefront of Boston neighborhoods in which to live, work, worship, and play. There have been pockets of understanding of the value of working to bring emerging technology enterprises into Roxbury, but much more remains to be done in this regard.

Among the local actions needed to move a new-economy agenda forward in Roxbury are initiatives similar to those that initially established the aborted Emerging Industry Center. Local politicians, the congressional delegation, and local business and community-development activists cooperated to secure the federal seed money for this venture. It was to consist of a biotech and high-tech business incubator with shared business services, along with an education and training component, as well as a venture-capital fund. Various small companies were to be recruited to this incubator, based on their likelihood

of success as biotech and new tech ventures that could be nurtured over an 18-month period and then graduate to larger facilities, ideally within the CrossTown Industrial Park. Such a business model is still appropriate in today's new dot-com economy.

In order for such a model to be organized, funded, and managed successfully, a coalition similar to the one that formed the Emerging Industry Center will have to be put together. At that time, city, state, and federal interests worked in tandem with local businesses and community developers interests. This time, however, there also needs to be greater sensitivity on the part of the outside business interests as to how best to enter Roxbury. It cannot be done in a high-handed, condescending fashion if it is to succeed.

There is also the potential to expand the existing presence of university and commercial biotech operations in Roxbury. It is expected that biotechnology and biomedicine will be key industries in the 21st century. A model for increasing the number of such firms in Roxbury, as well as the number of black and Hispanic workers in this industry, already exists at 801 Albany Street in CrossTown Industrial Park. The challenge is to take that model and expand upon it within the neighborhood.

Given the recent success of design and construction firms that are based in Roxbury or working on projects there, it is imperative to explore the dot-com connections that exist between the new economy and the real estate industry. The types of dot-com and e-commerce opportunities now being seeded throughout the nation suggest a fertile market for a community like Roxbury. During the past year, dozens of real estate–related dot-coms have entered the market. Some of them found and filled valuable niches, while others provided solutions to problems that were not readily apparent.

Whether or not the Internet will have a revolutionary impact on the commercial real estate industry, there are signs that real estate professionals are taking control of their electronic destinies. As Jim Miara states in his insightful article in the August 2000 issue of *UrbanLand,* after years of turning its back on technological innovation, the real estate industry is beginning to face it head on.

But to make all of this happen, perceptions have to change. The city of Boston must be able to see Roxbury as a potentially strong area for new-economy businesses. The traditional view of Roxbury, held at both the city and the state levels, must be replaced by a new vision that places Roxbury in the future, not the past. The paradigm of development needs to move beyond subsidized housing and service agencies to new-economy business development and wealth creation.

The barriers to this type of forward thinking are primarily mental. Just as it was difficult for some to envision a world dominated by the personal computer, where the average person can be connected to the entire world via the Internet, so, too, it will be a challenge for local and state politicians to see Roxbury in a new way.

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Lessons Learned from the Case Studies

What can be said about the role of telecommunications in the case study communities that may be of benefit to planners and economic development professionals? Key lessons can be of value to other communities. These are explained below.

Lesson One: Telecommunications is not an end in itself.

It is a tool that, along with other infrastructure elements, will help a community maintain and improve its competitive advantage. It will grow in importance only as economics transform. It is clear that all of the case study communities are in the midst of major economic transitions. For example, Lynn is shifting from serving as one of America's first and most important industrial centers to being host to some of Boston's modern high technology companies. Similarly, in New Bedford there are renewed efforts to shift from fishing to tourism, solidify the presence of education and research institutions and, as with Lynn, attract high technology companies. From a policy perspective, to aid in this transition, investments in high technology confirms that those cities are preparing themselves for the future.

Lesson Two: The pursuit of modern telecommunications cannot be seen as a one-city phenomenon.

It has been said that money and water know no boundaries. This can also apply to telecommunications. In the rural context, the best hope for improving services may be in regional approaches to upgrading the telecommunications infrastructure. All three urban case-study areas are clearly impacted by neighboring economic power centers. Roxbury's location advantage has the potential to create significant links with Boston's powerful financial services and high-tech economy.

Lynn is a critical sub-center of Boston and even New York City. New Bedford could very well become a sub-center of Boston and Providence. As such, they must match the telecommunications efforts in these cities if they are to maintain or improve their economic positions. This point is vividly illustrated by the fact that the state of Rhode

Island sees its primary economic "catchment area" as including all of Connecticut, Massachusetts, southern New Hampshire, and New York City: It will do whatever it can to create a climate of competitiveness that matches the telecommunications investments in these areas. New Bedford is less than forty miles from Providence and is well within its commuting range.

Lesson Three: A telecommunications network is not simply a tool of big companies.

Big companies may be key investors and have the greatest initial need for modern equipment and systems, but they are only a tiny fraction of the potential users. A look at the case studies shows that for every General Electric there are literally hundreds of small companies that will be upgrading their systems.

Economist David Birch defines companies in three categories: 1) Elephants, like Lynn's General Electric, are big, cumbersome, and slow to move, but when they move they carry everyone else with them; 2) Mice are small firms—like New Bedford's fishing firms—that start small, stay small, but have an ability to adapt and survive; and 3) Gazelles are the fast-growing, never-look-back firms that quickly push themselves into the national scene. There are hundreds of these gazelles now emerging in Greater Boston. The three categories share one characteristic: they must have modern telecommunications if they are to survive. Nowhere is this clearer than in North Adams, Massachusetts. Growing companies needed better and better telecommunications, but the city was slow to meet their needs. It almost lost them. Fortunately, the leaders were able to improve the systems, and the companies that survived are once again prospering.

Lesson Four: Cities and regions must be prepared to invest.

Boston must continue to invest to improve infrastructure and facilities in Roxbury. In the cases of Lynn and New Bedford, smaller cities with a large segment of low-income families, this requires a sacrifice. In the case of fiscally limited rural communities, regional efforts become the only hope. This means investing in an unknown future while current, pressing needs are often overwhelming. It's clear that these areas must plan

carefully and invest steadily. If nothing else, the telecommunications revolution has reinforced the need for cities to reinstate meaningful capital improvement planning and programming. Unfortunately, too many areas have been slow to move in this direction.

Lesson Five: There is a real need for cities (and regions) to become entrepreneurial.

A city that has tax increment financing (TIF) powers could negotiate for a wire network much greater than required in exchange for a break in taxes. The entrepreneurial city must also pursue grants and be prepared to use its eminent domain powers and craft unique zoning arrangements.

Rural regions, too, must be entrepreneurial in order to garner service. Berkshire County's Berkshire Connect efforts have been instructive to Franklin County's current efforts to improve infrastructure and service**.**

Lesson Six: Modern telecommunications are changing where and how we work.

There is a strong entrepreneurial spirit in Massachusetts, with new companies being formed regularly. These companies tend to be small, and most will stay small. And yet, almost all will require modern telecommunications. They also tend to be located in a home, have no more than one outside employee, and have few—if any—customers coming to the door. This phenomenon, along with the trend for more and more people to work at home, has created "virtual business zones" or "geography-free business zones." You can't see the business, you can't see the customers, and you can't see the suppliers (except for Fed Ex!), but they are there. It is essential that through our planning and zoning we create opportunities for these small companies to succeed. After all, locally funded companies tend to stay local.

Lesson Seven: It is essential that cities and their companies be—literally—on the same wavelength.

We know of too many cities where planners have ignored the needs of the business community. We urge cities, in their efforts to ensure that they are "state of the art" and

meeting local needs, to include questions concerning telecommunications as part of their regular business retention service.

Lesson Eight: Telecommunication systems, while a direct economic instrument of importance, must also meet the needs of all citizens.

Cities must develop plans to ensure that their schools, hospitals, senior centers, homes, and institutions are connected. Perhaps most significantly, efforts must include meeting the needs of our newest immigrants plus the poor, the unskilled, and the elderly. This will be no easy task.

Lesson Nine: Telecommunications planning cannot involve only one group or organization in a city.

Planning must involve the private sector, the investment community, and government at all levels. Moreover, decisions cannot be "stove piped"; they must be integrative.

Lesson Ten: Finally, like any major change, we do not know where, when—or if—the telecommunications revolution will end.

It is clear that we must be part of the revolution, be watchful, and be prepared for constant change. We are due for interesting times.

APPENDIX 1: Glossary of Technical Terms

ASCII- the most common format for text files in computers and on the Internet.

Bandwidth- (1) How fast data flows on a given transmission path, and (2) Somewhat more technically, the width of the range of frequencies that an electronic signal occupies on a given transmission medium. Any digital or analog signal has a bandwidth. Generally speaking, bandwidth is directly proportional to the amount of data transmitted or received per unit time.

Broadband – High speed network. Broadband refers to telecommunication that provides multiple channels of data over a single communications medium, typically using some form of frequency or wave division multiplexing.

Call Center - a central place where customer and other telephone calls are handled by an organization, usually with some amount of computer automation. Typically, a call center has the ability to handle a considerable volume of calls at the same time, to screen calls and forward them to someone qualified to handle them, and to log calls.

Digital Divide- The term 'digital divide' describes the fact that the world can be divided into people who do and people who don't have access to - and the capability to use - modern information technology, such as the telephone, television, or the Internet. The digital divide exists between those in cities and those in rural areas.

DSL (Digital Subscriber Line) — A form of digital telecommunications service that increases the capacity of the existing network of copper wire infrastructure. Variable bandwidths.

E -mail- E-mail (electronic mail) is the exchange of computer-stored messages by telecommunication. (Some publications spell it email; we prefer the currently more established spelling of e-mail.) E-mail messages are usually encoded in ASCII text. However, you can also send non-text files, such as graphic images and sound files, as attachments sent in binary streams. E-mail was one of the first uses of the Internet and is still the most popular use. A large percentage of the total traffic over the Internet is e-mail. E-mail can also be exchanged between online service provider users and in networks other than the Internet, both public and private.

Fiber Optic - Fiber optic (or "optical fiber") refers to the medium and the technology associated with the transmission of information as light impulses along a glass or plastic wire or fiber. Fiber optic wire carries much more information than conventional copper wire and is far less subject to electromagnetic interference. Most telephone company long-distance lines are now fiber optic.

IMAP (Internet Message Access Protocol) - A standard protocol for accessing e-mail from your local server. IMAP is a client/server protocol in which e-mail is received and held for you by your Internet server. You (or your e-mail client) can view just the heading and the sender of the letter and then decide whether to download the mail. IMAP requires continual access to the server during the time that you are working with your mail.

Information Technology (IT) — A term that encompasses all forms of technology used to create, store, exchange, and use information in its various forms (business data, voice conversations, still images, motion pictures, multimedia presentations, and other forms, including those not yet conceived). It's a convenient term for including both telephony and computer technology in the same word. It is the technology that is driving what has often been called "the information revolution."

ISDN (Integrated Services Digital Network) — A digital end-to-end service that enables each telephone line to offer three communications channels for carrying voice,

data, or even video. Any two of these communications modes can be utilized simultaneously. Designed to work over current twisted-pair wiring. Variable bandwidths.

Internet - The Internet, sometimes called simply "the Net," is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers).

Internet Service Provider (ISP) - An ISP (Internet service provider) is a company that provides individuals and other companies access to the Internet and other related services such as Web site building and virtual hosting. An ISP has the equipment and the telecommunication line access required to have POP (Point-of-presence) on the Internet for the geographic area served.

Kbps (kilobytes per second) - In the U.S., Kbps stands for kilobit per second (thousands of bits per second) and is a measure of bandwidth (the amount of data that can flow in a given time) on a data transmission medium. Higher bandwidths are more conveniently expressed in megabit per second (Mbps, or millions of bits per second) and in gigabit per second (Gbps, or billions of bits per second).

Mbps (megabytes per second) - Mbps stands for millions of bits per second and is a measure of bandwidth (the total information flow over a given time) on a data transmission medium such as twisted-pair copper cable, coaxial cable, or optical fiber. Depending on the medium and the transmission method, bandwidth may also be in the Kbps (thousands of bits or kilobits per second) range or the Gbps (billions of bits or gigabits per second) range.

Peering – An arrangement of traffic exchange between Internet service providers (ISPs). Larger ISPs with their own backbone networks agree to allow traffic from other large ISPs in exchange for traffic on their backbones. They also exchange traffic with smaller ISPs so that they can reach regional end points. Essentially, this is how a number of

individual network owners put the Internet together. To do this, network owners and access providers, the ISPs, work out agreements that describe the terms and conditions to which both are subject. Bilateral peering is an agreement between two parties. Multilateral peering is an agreement between more than two parties.

POP (Point-of-Presence)- Access point to the Internet. A POP necessarily has a unique Internet Protocol (IP) address. Your Internet service provider (ISP) or online service provider (such as AOL) has a point-of-presence on the Internet and probably more than one. The number of POPs that an ISP or OSP has is sometimes used as a measure of its size or growth rate.

POTS (Plain Old Telephone Service)— Analog or electronic transmission of voice and data over the twisted-pair copper wire infrastructure that was originally installed for use by telephones exclusively, i.e., predates widespread use of the Internet. Variable bandwidths.

T1/T3 — Terms for leased data connections with very high bandwidths, 1.5 Mbps and 45 Mbps (megabytes per second), respectively.

Telecommunications — Transmission of information over networks (wired and wireless), including data, voice, and video.

Touch Screen - computer display screen that is sensitive to human touch, allowing a user to interact with the computer by touching pictures or words on the screen. Touch screens are used with information kiosk, computer-based training devices, and systems designed to help individuals who have difficulty manipulating a mouse or keyboard.

Wireless Technologies — Transmission of voice or data using radio waves instead of electrical or light impulses. Antennas replace the network of wires. Variable bandwidths.

World Wide Web - A technical definition of the World Wide Web is: all the resources and users on the Internet that are using the Hypertext Transfer Protocol (Hypertext Transfer Protocol). A broader definition comes from the organization that Web inventor Tim Berners-Lee helped found, the World Wide Web Consortium (W3C): "The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge."

APPENDIX 2: IT Leading Industries, SIC Sector Definitions

Information Technology Sector

Infrastructure Providers	5045.0000	Wholesale computer and software
	5051.0100	Wholesale wire
	5063.0300	Wholesale cable
	5065.0000	Communications equipment
	5734.0000	Retail computer stores
	5999.0600	Retail telephone equipment
	1623.0200	Communication lines and towers
	1731.0300	Communication construction – wiring
	4812.0000	Wireless – cellular, beepers, paging, etc.
	4813.0000	Telephone services
	4822.0000	E-mail, facsimile
	4841.0000	Cable services
	4899.0000	Data services, satellites
	7379.0000	Communication services
	7389.1000	Answering services, telemarketing
	7629.0302	Telephone repair
	7629.9905	Telecommunications repair
	8748.0300	Communications consulting
	3357.0100	Wire, fiber-optic cable
	3571.0000	Computers
	3572.0000	Computer storage
	3575.0000	Computer terminals
	3577.0000	Computer peripherals
	3674.0200	Microprocessors
	3695.0000	Magnetic media
	3661.0000	Telephone equipment
	3663.0000	Communication equipment
	3669.0000	Communication equipment
	2741.0300	Telephone directories
Software Developers	7371.0000	Computer programming services
	7372.0000	Prepackaged software
	7375.0000	Information retrieval services
	7377.0000	Computer rental and leasing
	7378.0000	Computer maintenance and repair
	8243-9903	Data processing sub-division

IT Related Industries

Financial Services	6036.0000	Savings institutions
	6111.0000	Federal and non-federal sponsored credit
	6159.0000	Misc. business credit institutions
	6211.0000	Security brokers, dealers, Etc.

	6282.0000	Investment advice
	6289.0000	Services allied with the exchange of securities
	6311.0000	Life insurance
	6324.0000	Hospital and medical service plans
	6331.0000	Fire, marine, and casualty insurance
	6411.0000	Insurance agents, brokers, and services
	7323.0000	Credit reporting services
Consulting	8732.0000	Commercial nonphysical services
	8741.0000	Management services
	8742.0000	Management consulting services
	8733.0000	Noncommercial research organizations
	7373.0000	Computer integrated system design
	7374.0000	Computer processing & data preparation & processing services
	7376.0000	Computer facilities management services

APPENDIX 3: Best Practices Nationwide

This appendix provides a review of some of the best development practices implemented by "smart communities" around the United States. It contains 20 case studies of best practices nationwide. It should be noted that many of the studies reviewed here focus on one or two particular activities that a community has accomplished in its efforts to become a "smart city."

For the purposes of this study, the definition of the term "smart community" is the one developed by the World Foundation of Smart Communities (WFSC) in conjunction with the California Institute for Smart Communities (CISC) at San Diego State University. In a collaborative effort, WFSC and CISC have developed a comprehensive, two-volume, on-line Smart Communities Guide and Implementation Guidebook. This guide not only reviews several examples of case studies for community officials but also creates a framework that a town or city can use to become a "smart community." The WFSC/CISC's description of a "smart community: is as follows:

> A "smart community" is a community in which members of local government, business, education, healthcare institutions and the general public understand the potential of information technology, and form successful alliances to work together to use technology to transform their community in significant and positive ways.
>
> Because of these unified efforts, the community is able to leverage resources and projects to develop and benefit from telecommunications infrastructure and services much earlier than it otherwise would. Instead of incremental change, a transformation occurs which increases choice, convenience and control for people in the community as they live, work, travel, govern, shop, educate, and entertain themselves.
>
> Smart communities or regions are also economically competitive in the new global economy, and attract and promote commerce as a result of an advanced telecommunications infrastructure.
>
> Every smart community is unique because its characteristics are based on the community itself. One common denominator is that successful smart communities are the result of a coalition of business, education, government and individual citizens. A successful smart community can be built from the top down, or as a grass-roots effort, but active involvement from every sector of the community is essential. This united effort creates a synergy, which allows individual projects to build upon each other for faster progress, resulting in the involved, informed, and

trained critical mass necessary for transformation of how the entire community carries out its work.

An analysis of the case studies cited below reveals that many of the best practices and their implementation share some common factors:

- Strong public-private partnerships, with a commitment from both sectors to achieve a common goal;
- Development of a strong vision/mission statement for the community and ambitious yet achievable goals;
- Willingness of city governments to put public capital investment into programs and physical infrastructure development and improvements, in order to lead the way and show the private sector that the community is serious about exploiting telecommunications to promote economic development; and
- Development of effective public relations campaigns to promote the city and its assets.
- Incremental or phased technology development, both for budgetary purposes and to allow people time to understand and support the required changes and new benefits.

The first set of best-practice case studies is drawn from the WFSC/CISC's Smart Communities Guidebook. It is presented in the table below. Five more individual case studies follow.

Community	Example of Best Practice Implemented
Blacksburg, VA	Blacksburg is a university town of approximately 40,000 residents. In January 1992, town officials met with representatives of private industry and the local university, Virginia Tech, to discuss ways in which resources could be pulled

	from the three sectors to develop an electronic village. The proposed venture proceeded and five years later, in 1997, the electronic village concept was firmly established. Sponsors of the program have seen the following results: 40 percent of the town is on the Internet; 62 percent of residents use electronic mail; through cooperation with the public schools and libraries, all schoolchildren are allowed free e-mail accounts and free direct access to the World Wide Web; and more than two-thirds of town-based companies advertise on the Web with Web sites and on-line services, and these companies have reported real profit earnings from their Web-based activities.
Charlotte and Mecklenburg County, NC	A joint initiative called Charlotte's Web, sponsored and implemented by the Charlotte and Mecklenburg County Public Library System, utilized touch screen kiosks as a community project. On a relatively limited budget of $300,000, the program administrators were able to develop a high-quality kiosk system by using free or inexpensive software and a minimal hardware configuration. The standard Web browser Netscape was used for the kiosk interface and Linux, a free, Unix-like development tool, was used for the operating system. Through efforts such as these, administrators were able to hold costs down to less than $3,000 per kiosk.
Chula Vista, CA	In the critical planning phase of a smart-community initiative, the city of Chula Vista retained a reputable professional public relations company to undertake some of the initial public outreach activities for the city. The professional manner in which this part of the initiative was carried out proved invaluable. The city held two sets of activities organized by the public relations firm—two workshops, one for the general community and one for community leaders, and two discussion groups, one for non-English-speaking residents and one for "computer disenfranchised" residents and businesses. This dual workshop/discussion-group plan worked extremely well, increasing public participation and support for the smart community idea by allowing key groups to feel more comfortable in presenting their ideas, and provided an atmosphere in which residents welcomed the development of on-line community services to help them communicate with city officials.
Davis, Calif.	The University of California at Davis spearheaded the smart-community initiative in this town. The university initiated the Davis Community Network (DCN), whose goal was to bring local small businesses on-line. A collaborative agreement was reached with the Internet consulting firm Dynasoft, under which DCN provides free Internet accounts, technical support, and World Wide Web hosting and one-on-one assistance to local businesses. As a result, more than 95 of Davis's small businesses have come on-line and more than 80 businesses' Web

	sites are hosted through the program. Another part of the program, Dynasoft's Davis Virtual Market, has increased community outreach. The program has also allowed for the development of a small but exciting new teleshopping experience for local residents.
East Palo Alto, Calif.	In the heart of Silicon Valley, a local non-profit organization, Plugged In, has tried to bridge the gap between the neighboring high-tech companies and the community of East Palo Alto, which has not seen an increase in wealth from the high-tech boom. Plugged In provides a fully equipped computer center that is used by more than 200 community members. At the facility, residents can use state-of-the-art computers to do on-line research, complete homework assignments, and participate in more than 30 computer and computer-related classes presented in partnership with local agencies.
Compton, Calif.	The Blue Line TeleVillage project, implemented by the Los Angeles County government and funded through several government entities, provides residents with access to advanced computers, computer training, videoconferencing, e-mail and the Internet for small membership fees ranging from $5 for students to $50 for businesses and organizations.
San Bernardino, Calif.	The Enterprise for Economic Excellence (EEE) is a non-profit corporation whose focus is to help San Bernardino County schools. EEE acts as an Internet service provider (ISP) for individuals and businesses and promotes partnerships among participants. EEE has established network connections in at least one-third of the county's schools, helped in the county's attainment of a $25 million state technology grant, and rebates 8 percent of its ISP revenues directly to the schools.
Grass Valley, Calif.	This case study involves the collaboration of two organizations: the Nevada County Community Network (NCCN) and the Western Nevada County Transportation Management Association, which operates the Grass Valley TeleBusiness Center. The project has allowed the TeleBusiness Center to grow from a telecommuting site into an economic-development tool. The project has served as a small-business incubator for start-up businesses and for individuals who have outgrown their home-business locations. The network has grown to more than 1,000 users.
Los Angeles, Calif.	The Los Angeles Freenet (LAFN) provides low-cost Internet access, at $15 per year, to more than 10,000 subscribers in the Greater Los Angeles area. Initiated by a local physician who wanted to provide on-line medical information, LAFN's goal is to offer access to all users. Run mainly by 200 volunteers, the LAFN provides medical information, e-mail, World Wide Web access, and voter

	information.
Sacramento, Calif.	The Net at Two Rivers (N2R) is a non-profit organization whose programs reach from the center of the state of California to its eastern border and into Nevada. N2R has worked to develop partnerships between schools, businesses, government agencies, hospitals, libraries, non-profit groups, and volunteer groups. In addition, N2R has established 50 public access sites in its 15-county area. These sites offer literacy training, free Internet instruction (in exchange for volunteer hours), and localized public information on wellness, disaster preparedness, job-seeking skills, voting, child-abuse prevention, and crime prevention.
San Carlos, Calif.	ABAGOnline was developed by the Association of Bay Area Governments to create an electronic link to local governments in the San Francisco Bay Area as well as a hosting service for government agencies lacking the resources to maintain an independent Internet server. ABAGOnline offers links to more than 100 Bay Area agencies. The city of San Carlos utilized the project to get its municipal offices on-line. With the help of ABAGOnline, the city's on-line presence has grown from a few Web pages to an independent server that is a one-stop shop for information regarding the city.
San Diego, Calif.	San Diego State University developed its International Center for Communications in 1990 to examine the emerging relationship between communications and the community. The director of the Center was asked to chair a public-private "City of the Future" committee to determine how the San Diego could best take advantage of the new telecommunications technologies. The committee recommended that the city focus on the on-line delivery of government, health, and educational services and create an electronic presence to promote the growth of local businesses. The city launched an aggressive RFI/RFP process. Because of the collaboration's forceful vision, private industry became excited and wired the community itself, tripling the amount of deployed fiber-optic cable in just two years.
San Diego County, Calif.	The International Center for Communications at San Diego State University helped to develop an alliance between the city of San Diego, the county, and two major technology companies, NCR and Maxwell Laboratories, to create a network of public-access kiosks throughout the county. The county will open at least 50 kiosks in the first quarter of 1997. The kiosks initially provided direct public access to a wide array of city and county data, and have subsequently been augmented to give San Diegans the ability to pay fees, order documents, and submit job applications on-line.

San Francisco, Calif.	The San Francisco Public Library, in conjunction with several public/private partners, has proposed the development of a new program called City Link/Bridge. The developers of this program plan to make cultural, educational, health-care, and information services available free to the public over a variety of telecommunications media, including the Internet and public broadcasting television stations. The idea is to transform libraries from their traditional role as book repositories into comprehensive community resources. One unique service planned is "Response TV," in which viewers can use an ordinary telephone keypad to bring information to the television screen, and possibly to be able to participate in interactive community polls.
Seattle, Wash.	The Seattle city government has funded the Seattle Public Access Network (PAN), which consists of a free public World Wide Web site, an FTP and e-mail server, and a bulletin board system. PAN's primary focus is to serve as an electronic City Hall, allowing Seattle citizens to communicate with city officials and to obtain city information and services electronically. PAN has extensive network connections in the Seattle area, and the site is unsurpassed in the amount of Seattle information it maintains. Content-creation responsibilities are delegated to the various departments and organizations inside and outside the city government.
Silicon Valley, Calif.	Smart Valley, an association of more than 75 Silicon Valley companies, acts as an independent, unbiased broker between technology manufacturers, service providers, application developers, and end users to implement technology projects that will enhance the quality of life in this high-tech region. Smart Valley's vision is to create an electronic community by developing an advanced information infrastructure linking all sectors of the community—education, health care, local government, business, and the home. Examples of projects undertaken by the association include efforts to create an Internet-linked, kiosk-based public-access network throughout the San Francisco Bay Area; to wire and connect 150 Silicon Valley schools to the Internet; to connect area youth with potential employers; to help municipalities develop on-line permitting systems; to increase telecommuting; and to construct a state-of-the-art election Web site for Silicon Valley voters.

(Source: *Smart Communities Guidebook,* at http://www.smartcommunities.org reviewed 3/27/00).

The following case studies are additional best-practices identified by the study team:

Community	Example of Best Practice Implemented
Telitcom Development Corporation, Springfield, Mass.	The main purpose for the creation of Telitcom Development Corporation was to market Western Massachusetts as an advanced telecommunications and information-technology hub. Telitcom serves as a one-stop clearinghouse and counselor for existing and prospective information-dependent and technology-intensive companies requiring access to capital, regulatory and permitting information, or other resources. Telitcom helps to facilitate and coordinate large-scale technical projects and collaborative efforts. The Regional Business Alliance (REBA), initiated by Telitcom, has undertaken a technology planning effort for schools throughout Western Massachusetts. Twelve of REBA's school districts are involved in this initiative, which maximizes connectivity and enhances professional development activities. Source: http://.www.teleitcom.org/
TechCtr@Boston, Boston, Mass.	TechCtr@Boston is the result of a public-private partnership between the city of Boston and the Druker Company. It is described as a place where small start-up firms in the new high-tech industries can co-locate, share resources, and create a community. It is proposed that TechCtr@Boston will act as a unique resource for the Greater Boston community, and will serve as a clearinghouse for local businesses interested in contracting with these innovative start-ups. The project creates a nurturing environment for start-up businesses; fosters the development of a community of peers and enables the creation of synergistic relationships among them; Offers office space at affordable rents and lease terms; Provides reliable state-of-the-art, high-speed access to the Internet; creates an investment opportunity for the public sector; and establishes Boston's intention to remain a leader in the technology world. Source: http://www.techctrboston.com
LaGrange Industrial Park and Telecommunications Infrastructure, LaGrange, Ga.	LaGrange, Georgia, is located near the Alabama state line and approximately 70 miles from downtown Atlanta. The LaGrange Community and Economic Development Department was initially responsible for implementing the telecommunications initiative for the city. The city reorganized the function and placed it within its Utilities Department, which was composed mainly of engineers and specialists who possessed the necessary technical skills. LaGrange put into action

	two initiatives to upgrade its telecommunication infrastructure. Between 1993 and 1995 the city spent $75,000 to install a four-mile ring of dark-fiber cables on its existing electric poles. It then engaged in an innovative partnership with the local private-sector cable company, St. Louis–based Charter Communications, for the provision of service capabilities. Parallel to its infrastructure development activities, the city also gave attention to the expansion of its educational and training offerings in the telecommunications field. The community created a program called TechPrep to offer a vocational and technical training track for non-college-bound students. The program, involving the high school and the local technical institute, provided training in computer operation, diction, and telephone deportment. Through a statewide program, the technical institute obtained additional telecommunications resources, which dramatically increased its capacity to train workers for telemarketing and technical positions. In addition, the city created new approaches to marketing itself to telemarketing firms. These included the development of a new public relations brochure that highlighted all relevant technical attributes of the city's telecommunications infrastructure, and the creation of a business and industrial section on the city's Web site that includes all the basic information that site location consultants require. Source: http://www.ceds.gatech.edu/bestpractices/cases/Lagrange.htm
SmartCities, Kansas City, Mo.	The SmartCities campaign was developed from a thorough analysis of the Kansas City area's assets and liabilities in comparison with other cities. Through research it was found that Kansas City is ideally suited for "knowledge-intensive, telecommunications-dependent" corporations (i.e., companies that are considered "smart"). The goals of the campaign are ambitious. they include (1) attracting telecom-intensive companies and other technology developments to the Kansas City area; (2) finding ways to utilize technology to streamline and enhance the economic-development process in Kansas City; (3) encouraging the continued expansion of Kansas City's information infrastructure to keep the community a leader in data sharing, image and voice communication, and other technology developments; and (4) bringing attention to Kansas City as a global center for communication technology, education and research. Kansas City continues to be recognized as a "smart city" for business. In

	the past several years, firms including Sprint PCS, AlliedSignal, Gateway, and State Street have chosen the Kansas City area for major high-tech operations. In addition, a number of "smart" initiatives have been developed to support the growth of high-tech businesses in the area. These include inner-city work centers that use technology to move work to where available workers live; SmartTec, aimed at helping small, fast-growing, technology-based businesses; ITEC, an annual technology exposition; and up-to-date Web sites that offer in-depth development data. Source: http://www.smartkc.com
Telecom City, Everett, Malden, and Medford, Mass.	The eastern Massachusetts cities of Malden, Medford, and Everett have formed an innovative tri-city partnership to create a regional technology-development project, TeleCom City (TCC), in the Mystic River region of the Greater Boston area. The project will involve several universities, federal and state government agencies, and private companies in an effort to reposition an abandoned manufacturing-based economy into the new global technology-based economy. TCC will be state-financed, but locally driven and implemented. The main goal of the project is to convert a 200-acre underutilized and blighted industrial site into a $750 million state-of-the-art regional telecommunications center that will capitalize on the cutting-edge technologies of the Massachusetts telecommunications industry to spur international investment. A unique feature of the TeleCom City project is that Malden, Everett, and Medford are erasing part of their political borders to share physical as well as funding resources. In July 1993, Malden and Medford created a collaborative land-use plan and economic-development strategy to better utilize a two-city parcel of land. Soon Everett joined the project, and in March 1995 the three communities signed an agreement to create a single set of zoning, tax and regulatory requirements. They have set forth state legislation that will establish a single tax and zoning law and authorize the use of $100 million in state bonds for infrastructure improvements and preparation work.

Sources: http://www.telcomcity.com; Svetlana G. Karasyova, "A Collaborative Approach to Economic Development: A Case Study of Telecom City in Malden, Medford, and

Everett, Massachusetts," September 1997, Dept. of Landscape Architecture and Regional Planning, University of Massachusetts, Amherst.

APPENDIX 4: List of Proposed Indicators to Be Utilized in Evaluating the Use of Telecommunications as an Economic Tool

1. Telecommunications Infrastructure Indicators:

- Cable TV companies and service areas
- Trunk lines
- End user connections/subscribers
- Cable modems and enhanced digital services
- Cellular phone and wireless communications companies and service areas
- Towers and antennas
- Subscribers
- Microwave towers and service areas
- Companies
- Long distance phone providers/carriers
- Infrastructure
- End users/customers
- Local phone companies/carriers
- Infrastructure
- End users/customers
- ISDN, DSL, and ATM service areas and customers
- Fiber-optic trunk line providers/owners
- Fiber lines and connections (dark and light)
- Satellite up and down links
- Companies and services
- Service areas and subscribers
- Internet service providers

- Lines and connections
- Service areas and subscribers
- Telecommunications hardware and software companies
- Infrastructure
- Business networks infrastructure
- Public sector infrastructure
- Government, universities, schools, libraries, medical, emergency, R&D labs
- Roads, railroads, pipelines, and other rights-of-way

2. Other Economic and Ecological Indicators (geographically located)

- Existing business growth, health, and location changes
- New business locations
- Investment and subsidy of telecommunications infrastructure, public and private
- Existing and new jobs, sectors, earnings
- Tax revenues
- Home construction
- Commercial construction
- Banking, lending and investment
- E-commerce
- Poverty
- Educational level changes
- Economic sector ratio changes—agricultural, industrial, service
- Transportation and commuter patterns
- Air quality

- Health-care and social services
- Government efficiencies
- Crime
- Ethnic and racial diversity

Source: http://www.radlab.com/tele-community/smartgrowth.html. The site creator is Richard Lowenberg, Executive Director of Davis Community Network (DCN) and its Yolo Area Regional Network (YARN) initiative.

APPENDIX 5: Telecommunications Theory

Imagine doubling this nation's highway capacity a couple of times every year. That is precisely what is happening with the country's telecommunication networks. There is a constant race to increase bandwidth. Unlike roadways, where heavy construction can bring traffic to a standstill, new telecommunications networks are laid almost invisibly, with little or no interruption in service. Most often no one even notices, except for the few businesses that rely upon the latest speed advantages and consumers who compete for the fastest Internet service on the block.

A relatively new and expanding body of literature has emerged, focusing on the impact that telecommunications have had upon economic, social, political, and spatial relationships in our towns and cities. Although there is a consensus that this impact has been profound, there are differences of opinion on whether telecommunications have had a positive or a negative effect upon the quality of life. The debate tends to revolve around five sometimes competing concepts that seek to explain aspects of how telecommunications affect the economic development of cities.

1. The Integration Approach Concept

Telecommunications must be integrated into the fabric of economic and community development planning. They cannot be viewed as a panacea for economic development in a community.

Stephen Graham and Marvin Simon, in their comprehensive book *Telecommunications and the City: Electronic Spaces, Urban Places*,[54] describe four competing perspectives on telecommunications and the city. The first two perspectives, **technological determinism** and **futurism and utopianism**, paint an optimistic picture of the city in the age of telecommunications. The second two, **dystopianism and political economy** and **the social construction of technology**, view technological advances skeptically and question their ultimate worth in facilitating greater equity. These perspectives illustrate the range of debate on telecommunications theory. Graham and Simon believe that the two latter perspectives are the most relevant to planning and economic development.

[54] London and New York: Routledge, 1996.

Technological Determinism

Technological advances roll along like ocean waves: people enjoy their benefits, hardly notice their damaging effects, and are impotent to stop their force. Therefore, technological determinists argue, telecommunications innovations are inevitable and society must adapt to the sweeping changes they "wash ashore." Graham and Simon identify two key arguments put forth by technological determinists:

> "First, technological change is of overwhelming importance in directly shaping society. Second, the forces that stem from new telecommunications innovations are seen to have some autonomy from the social and political processes." (83)

Consequently, the result of telecommunications advances is the spatial and economic decentralization of cities. While decentralization has occurred in certain manufacturing and service industries, Graham and Marvin contend that, in fact, telecommunications have had a centralizing effect upon core business and financial operations.

Futurism and Utopianism

Cisco Systems' advertising campaign asks, "Are you ready?" Like thousands of telecommunications companies boarding the technology train, Cisco has a vested interest in portraying a better world that will emerge from the Internet revolution. While large transnational corporations are hardly the sole proponents of telecommunications advances, they have been the loudest among the IT boosters known as utopianists and futurists. According to Graham and Simon, "utopianists tend to see new telecommunications . . . technologies as being solutions to the social, environmental and physical problems they associated with the industrial city" (86). Futurists, meanwhile, view telecommunications as the road to country living, as innovations such as telecommuting enable people to permanently escape from urban areas.

Dystopianism and Political Economy

The Orwellian society laid out in *1984* is represented in the dystopianists' and political economists' vision of society in the age of advanced telecommunications. In this view, transnational corporations use and manipulate telecommunications to perpetuate the status quo and to advance their influence over consumers. Privacy watchdogs such as William Safire of the *New York Times* sound the alarm, warning against corporate intrusion, through telecommunications networks, that shrinks the private sphere. According to Graham and Simon, the public and private spheres are engulfed in a corporate takeover bid whereby "dominant institutions—primarily transnational corporations (TNCs)— are seen to use the space- and time-adjusting capabilities of telematics to their own benefit while purposefully excluding possible benefits from others" (96). The exclusionary practices of corporations, therefore, threaten to widen the digital divide. Dystopianists and political economists argue for political supervision and intervention to protect consumers from corporate invasion and exploitation of telecommunications systems.

The Social Construction of Technology (SCOT)

The SCOT perspective contends that the vast telecommunications networks that have proliferated in recent decades are simply a part of the greater social, political, and economic web woven by society. According to Graham and Simon, "The purpose of research in the SCOT tradition is, therefore, to understand how technology and its uses are socially and politically 'constructed' through complex processes of institutional and personal interaction, whereby many different actors and agencies interplay over a period of time" (105).

Unlike the dystopianists and political economists, SCOTs do not forecast "doom on the horizon"; rather, they believe that society has a modicum of control over telecommunications systems. Furthermore, the control and monitoring of telecommunications can be best exercised on the micro level on a case-by-case basis. Planners, politician and adjudicators, Graham and Simon argue, must arm themselves with all the weapons at their disposal to implement sound telecommunications policies.

Integration

Rather than viewing telecommunications innovations as sweeping in a utopian reality over which society has little control, the warnings of corporate exploitation and the call for telecommunications supervision must be heeded. One clear lesson that has been learned from the bitter Microsoft antitrust litigation is that technology supervision is a hazy process full of ambiguities and nuances. This lesson needs to be applied to telecommunications planning. Telecommunications technologies are changing very fast. Therefore, Graham and Simon state, "it is essential that telecommunications planning is fully integrated into the fabric of social and economic planning, so that society can act proactively rather than reactively to changes in the telecommunications industry" (113).

2. The Zero-Sum Game Concept

As advanced telecommunications become more pervasive, they provide less of a competitive advantage. Consequently, the race for telecommunications supremacy becomes a zero-sum game.

Domestic and international competition for businesses and jobs is increasingly fierce. Telecommunications infrastructure is an important factor to attract businesses, but only if the city or region possesses an overall competitive advantage. It is increasingly difficult to maintain a competitive advantage through telecommunications technologies alone. According to Geoffrey Little, president of Telitcom Development Corporation in Springfield, Mass., "Telecommunications gets you into the game, but it is only one piece in the competition for business." If the only ace in a city's hand is telecommunications, businesses will locate elsewhere.

3. The Modern Location Concept

Telecommunications are an important factor in attracting and retaining businesses, but increasingly quality-of-life measures, such as educational systems, cultural offerings, and environmental qualities are the determining factors in firm location.

The workday ends and employees stream from the office. Some head around the corner to have a beer and listen to some jazz. Perhaps a few head out to the nearby mountain biking trails to take advantage of the waning sun and to work off steam. Others, whose energy has been drained by the long workweek, take the short commute home to the La-Z-Boy. Workers are people and often the decisions they make about their jobs have little to do with telecommunications networks or tax incentives and a lot to do with the leisure activities the region offers or the quality of local schools. In 1999, Robert Mugerauer conducted informal interviews with high-technology company heads and concluded that quality-of-life measures are increasingly important in deciding where to locate a company.[55]

Quality of life is important to employees and consequently it is important to companies that are competing for a small pool of qualified workers. Regardless of the superiority of the telecommunications infrastructure, if people do not want to live in a city or region, companies will not locate there.

4. The Knowledge-Based Economy

Increasingly, the driving forces behind advanced Western economies are "knowledge-based" industries that rely heavily on information and innovation as their primary outputs. Concurrently, advances in telecommunications have made it easier to ship manufacturing and back-office operations overseas.

Company X has its headquarters in New York City, its customer support in Nebraska, and its manufacturing facilities in Malaysia. This fictitious company is representative of the spatial arrangement of many modern corporations. In the modern knowledge-based economy, while core business operations are still located in the center cities, where face-to-face exchanges of information can take place, service and manufacturing operations

[55] Robert Mugeraur, "Milieu Preferences among High-Technology Companies," in *Cities in the Telecommunications Age,* edited by Yoko Aoyama, Barney Warf, and James O. Wheeler (New York: Routledge, 2000), 219–27.

are being decentralized to other locations, where they can be operated inexpensively via telecommunications networks.[56]

Silicon Valley in northern California and the Route 128 belt around metropolitan Boston are two of the best examples of this phenomenon. Even though both regions are very expensive ones in which to live and do business, they remain centers of innovation in the knowledge-based economy because they offer access to brainpower, which is the driving force behind the "new economy."

5. The Widening "Digital Divide"

Since the deregulation of the telecommunications industry, telecommunications infrastructure improvements have chased corporate profits. If this trend continues it threatens to widen the "digital divide" between the technological haves and have-nots, leaving large segments of the public and private sectors behind.

The telecommunications industries improve and expand their networks where profits are likely to be the highest, near high-tech businesses and wealthy communities. Under such a system, inequity in access to telecommunications tends to prevail. Zenia Kotval argues that "it is clearly the isolated, handicapped, and economically disadvantaged social groups that can reap the greatest benefit from telecommunications in overall empowerment and quality of life, job searches, alternative methods of employment, education, and advanced communication."[57] Unfortunately, these populations are precisely the ones that find themselves on the wrong side of a digital divide that is increasingly difficult to leap across.

Conclusion

If the ultimate goal of planning is to achieve greater equity, then it is critical that telecommunications be incorporated into community and economic planning. History has

[56] William B. Beyers, "Cyberspace or Human Space: Wither Cities in the Age of Telecommunications?" in *Cities in the Telecommunications Age,* 161.
[57] Zenia Kotval, "Telecommunications: A Realistic Strategy for the Revitalization of American Cities," *Cities* 16, no. 1 (1999): 37.

repeatedly shown that while capitalism is spectacularly efficient, it is not always equitable. Information technologies have great potential, but if uncontrolled, they threaten to further exacerbate existing inequities in the social order. With proper supervision and regulation, telecommunications can act as an equalizer, helping to level the social, political, and economic playing field.

APPENDIX 6: Government Regulation of Telecommunications

1. Federal

At the federal regulatory level, telecommunication is governed by the Telecommunications Act of 1996. The underlying goal of the Act is "to provide for a pro-competitive, de-regulatory national policy framework designed to accelerate rapidly private sector deployment of advanced telecommunications and information technologies and services to all Americans by opening all telecommunications markets to competition, and for other purposes."

According to the Congressional Conference Report accompanying the Act, the legislation "touches almost every aspect of communications, including: telephone services, including local, long-distance, and wireless; free, over-the-air broadcast television; cable television; and content and programming on television and computer networks, including the Internet." The report makes three very important points about the Act: (1) it "promises that all Americans will be served by telecommunications systems"; (2) although there are many deregulatory aspects to the Act, a number of its provisions actually increase regulation; and (3) the new telecommunications landscape created by the Act can be shaped by the public "through input to the implementation decisions being made at the federal, state, and local levels." [58]

2. State

In the Commonwealth of Massachusetts, there is no single law or set of regulations (C.M.R.) providing a comprehensive regulatory framework for telecommunications. The state's regulatory framework is fragmented, with different telecommunications issues governed by numerous independent Massachusetts General Laws (M.G.L.) and Commonwealth of Massachusetts Regulations (C.M.R.), including the following:

- M.G.L. Ch. 25 – Department of Public Utilities;

[58] The report is posted on http://www.benton.org/Library/Landscape/landscape.html

- M.G.L. Ch. 93 – Massachusetts Slamming Law;
- M.G.L. Ch. 159 – Common Carriers;
- M.G.L. Ch. 166A – Community Antenna Television Systems;
- M.G.L. Ch. 272, Sect. 99 – Interception of Wire and Oral Communications
- MA 801 C.M.R. 1.00 – Standard Adjudicatory Rules of Practice and Procedure; and
- MA 207 C.M.R. 2.00 – General Rules

Glossary, continued

Levels of Capacity Provided by Various Types of Service

Power Level	Bandwidth	# of Full Time Jobs	Characteristic Business Use
Dial-up	12-–56 Kbs	1-–2	- Access Web infrequently - E–mail infrequently - Speed of transfer unimportant - Simultaneous use of phone and Internet not necessary.
ISDN	112 Kbs	2–24	- Occasional use of web - More frequent email use - Need ability to use phone and Internet simultaneously.
Emerging (DSL)	144—256 Kbs	Up to 25	- Access the Web occasionally - E-mail or transfer very few large files and documents - Do not host own Web site
Growth (DSL)	384-–512Kbs	Up to 75	- Have many people simultaneously accessing the Web - E-mail or transfer large files and documents - Host own Web site
Mission-Critical (DSL—T1)	768Kbps-–1.54Mbs	Up to 150	- Rely on the Internet to conduct business - Have many people simultaneously accessing the Web - E-mail or transfer large files and documents - Host own Web site

Source: Based on HarvardNet Business SpeedDSL Power Level Chart

http://www.harvardnet.com/infocenter/dslbest.phtml